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ESTIMATES - FY 1941

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VOLUME NO. 2

EXPLANATORY NOTES

FOR

DEPARTMENT OF AGRICULTURE

BUDGET ESTIMATES

FISCAL YEAR

1941

U. S. D. A.
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FOREST SERVICE

(a) GENERAL ADMINISTRATIVE EXPENSES

Appropriation, 1940	\$607,500
Budget Estimate, 1941	<u>602,000</u>
Decrease	<u>5,500</u>

PROJECT STATEMENT

Project	1939	1940 (Estimated)	1941 (Estimated)	Increase or decrease
General administration and business service	\$607,500	\$607,500	\$600,000	- \$7,500(1)
Additional for administrative: promotions	---	---	2,000	+ 2,000(2)
Total appropriation....	607,500	607,500	602,000	- 5,500

INCREASE AND DECREASE

The net reduction of \$5,500 in this item for 1941 consists of:

(1) A decrease of \$7,500 in working funds. This reduction will be met by reducing expenditures for travel and equipment.

(2) \$2,000 additional estimated for administrative promotions in accordance with the plan which is being uniformly applied in the Budget Estimates for 1941.

WORK UNDER THIS APPROPRIATION

This appropriation is used to provide a minimum of essential general administration, leadership, coordination, service facilities, and inspection of Forest Service work.

SUPPLEMENTAL FUNDS

Project	Obligated, 1939	Estimated obligations, 1940
Emergency Relief, Agriculture, Forest Service (Transfer from W.P.A.): General administrative expenses	\$91,142	\$75,000

(b) NATIONAL FOREST PROTECTION AND MANAGEMENT

Appropriation, 1940	\$12,004,000
White Mountain National Forest (a)	+ 437,769 (a)
Transferred in estimates for 1941 to "Salaries and Expenses, Office of the Solicitor"	- 1,600
Total available, 1940	<u>12,440,169</u>
Budget estimate, 1941	<u>12,120,485</u>
Decrease	<u>- 319,684</u>

(a) This is the amount carried forward into 1940 from a \$500,000 appropriation provided in the First Deficiency Appropriation Act, 1939, for the fiscal year 1939 and continued available until June 30, 1940.

PROJECT STATEMENT

Projects	1939	1940 (Estimated)	1941 (Estimated)	Increases or decreases
1. Timber use	\$1,337,749	\$1,364,936	\$1,328,983	- \$35,953(1)
2. Forest fire prevention and preparedness	3,254,689	3,318,885	3,231,467	- 87,418(1)
3. Forest fire suppression ...	254,402	254,881	248,168	- 6,713(1)
4. Protection against tree insects	134,076	134,632	131,086	- 3,546(1)
5. Control of blister rust and other diseases	484,133	735,287	935,287	+ 200,000(2)
6. Timber stand improvement...	46,724	47,115	45,874	- 1,241(1)
7. Reforestation and revegeta- tion of denuded areas.....	236,704	240,301	233,971	- 6,330(1)
8. Nurseries and planting stock	213,491	216,742	211,033	- 5,709(1)
9. Grazing use	1,239,175	1,295,874	1,261,741	- 34,133(1)
10. Recreation and land use ...	631,949	636,896	620,120	- 16,776(1)
11. Land classification, settle- ment, and claims	97,264	98,295	95,706	- 2,589(1)
12. Acquisition of land by direct purchase.....	152,752	155,101	151,016	- 4,085(1)
13. Acquisition of land by exchange	127,627	128,473	125,089	- 3,384(1)
14. Fish and game protection...	415,769	420,007	408,943	- 11,064(1)
15. Construction of truck and horse trails	333,822	338,149	329,243	- 8,906(1)
16. Maintenance of truck and horse trails	204,672	207,785	202,312	- 5,473(1)
17. Construction of improvements other than roads and trails..	672,581	691,484	673,271	- 18,213(1)
18. Maintenance of improvements other than roads and trails:	1,430,442	1,430,496	1,392,817	- 37,679(1)
19. General surveys and maps...	157,407	159,719	155,512	- 4,207(1)
20. Cooperation with other de- partments, bureaus, and agencies	120,872	121,342	118,146	- 3,196(1)

PROJECT STATEMENT - Continued.

Projects	1939	1940 (Estimated)	1941 (Estimated)	Increases or decreases
21. Hazard reduction, fire pre- vention and timber use, White Mountain National Forest	\$62,231	\$437,769	\$100,000	-\$337,769(3)
22. Additional for administra- tive promotions	---	---	114,700	+ 114,700(4)
Unobligated balance	21,754	---	---	---
	(a)	(b)	(c)	
Total	11,630,285	12,434,169	12,114,485	- 319,684

(a) Includes for 1939 \$62,231 appropriated by First Deficiency Act, 1939; excludes \$500 transferred to Bureau of Standards and \$6,000 transferred to Bureau of Agricultural Economics.

(b) Includes for 1940 \$437,769 appropriated by First Deficiency Act, 1939; excludes \$6,000 transferred to Bureau of Agricultural Economics.

(c) Excludes \$6,000 to be transferred to Bureau of Agricultural Economics.

INCREASES AND DECREASES

The net reduction of \$319,684 in this item in fiscal year 1941 consists of:

(1) A decrease of \$296,615 applied proportionately over 19 projects, offsetting an increase of \$200,000 in project 5, "Control of blister rust and other tree diseases", and an initial allotment of \$100,000 (from this appropriation) for project 21, "Hazard reduction, fire prevention and timber use, White Mountain National Forest". (See also item "3", which follows). The decrease has been spread proportionately over all projects except the two listed above because of the impossibility of determining at this time where the reduction can be applied with the least retardation of essential activities. The decrease will be effected by reducing the force of employees and by curtailing other obligations fairly evenly over all National Forests.

(2) An increase of \$200,000 for control of blister rust in the Inland Empire (Northern Idaho, Western Montana, and Northeastern Washington) and in California.

Western white pine--the mainstay of the Inland Empire lumber business--is doomed to extinction unless the white pine blister rust can be controlled. The same is true of sugar pine in California and Oregon. Through cooperation with the Bureau of Entomology and Plant Quarantine, control areas have been established, in which a planned attack is made by eradicating the alternate host--currant and gooseberry bushes. More than 7 years work in the Inland Empire has resulted in initial treatment of 967,838 acres of National Forest land, but due to the inadequacy of funds available more than 400,000 acres within present control areas have not been given even an initial working. The disease is established over much of the unworked territory and each year exacts its toll of dead and dying trees. Mortality is quicker in reproduction--

the young trees which constitute the basis for future employment in logging and milling.

Additional funds are urgently needed for the protection of this large area of important timber land. Not only must the remaining area be given initial treatment, but repeat treatments on lands worked several years ago are absolutely essential in order to eliminate bushes which have grown since the first working.

The disease is of more recent establishment in the sugar pine region although it is exceptionally virulent on this species. Less than 1/4 million acres have been given initial treatment nearly 3/4 million acres is in urgent need thereof.

The disease spreads rapidly. It is sure death to infected trees--particularly young trees. It can be controlled, but early completion of first working of all areas where the susceptible species are of commercial importance is essential to the continued production of these valuable woods. Every possible use is being made and will be made of emergency funds and labor--CCC, ERA, WPA. Many of the areas needing treatment, however, are so remote that it is impracticable to use laborers paid from such funds, due to restrictions on amount available for travel and subsistence. The requested increase is urgently needed if control work is to be kept ahead of the disease.

(3) A decrease of \$337,769 for hazard reduction, fire prevention, and timber use on the White Mountain National Forest in New Hampshire and Maine. While this item appears as a decrease in the project statement above, the \$100,000 allotment shown in the 1941 column represents the initial allotment under the regular appropriation procedure. (\$500,000 was appropriated in the First Deficiency Act of 1939, of which amount, \$62,231 was expended in 1939 and \$437,769 will be expended in 1940.)

The \$100,000 allotment in 1941 is required to continue the hazard reduction and emergency fire control work necessitated by the disastrous hurricane of September 1938. The hazard caused by the blown down timber will increase each year until 1943 as it continues to dry out. For the next eight or ten years following 1943 the hazard should gradually decrease to normal as it existed prior to the hurricane.

The hurricane has resulted in entangled jungles of wind-blown timber covering 180,000 acres of the total 700,000 acres of National Forest lands within the boundaries of the White Mountain National Forest. From the fire protection phase of the job an additional estimated 100,000 acres which would fall both within and without the White Mountain National Forest boundaries on private holdings add to the acute problem now being faced on this unit.

The funds included in this estimate will be used for the construction of additional fire breaks through the larger bodies of wind-thrown timber, the development of water holes for use as pump sets, and the employment of additional guards and emergency suppression squads during periods of fire danger. A minor amount will be used in salvaging timber.

(4) \$114,700 additional is estimated for administrative promotions in accordance with the plan which is being uniformly applied in the Budget Estimates for 1941.

CHANGE OF LANGUAGE

It is recommended that the words "areas under Forest Service administration" be added to the language of this item.

This change will permit the expenditure of funds from this appropriation on experimental areas, mainly range lands, which are not provided for under the existing language. The areas of land in experimental ranges upon which expenditures cannot be made under the existing language are small and the amounts required for construction and maintenance of improvements will not constitute a heavy drain upon this appropriation.

WORK UNDER THIS APPROPRIATION

Protection and Management of the National Forests

1. Timber Use.--- The Act of June 4, 1897, provides for the sale of timber from the national forests and in addition requires that a "continuous supply" be provided for. Thus sales are authorized on the sustained yield basis, with the forest treated as a renewing crop. This requires that timber stands be mapped and "cruised" or inventoried; growth rates determined logging chances defined; the social and economic factors of dependent communities investigated. These data are then assembled in timber management plans which prescribe methods of cutting and orderly programs for the removal of mature timber at rates which provide for replacement of amounts cut through growth.

Under these plans, timber is offered for sale on the stump, as it is ready for cutting and as it is needed by the industry. Each body of timber is appraised before being offered for sale. Each timber sale is carefully supervised so as to insure that the operator cuts only those trees marked or designated for cutting and otherwise complies with the terms of the individual contract. The operator is required by law to pay for the timber in advance of cutting, but payment is on the basis of the actual scale of the sawlogs or other forest products cut and removed. Logging debris is required to be disposed of so as to leave the cutover area in satisfactory condition for future growth.

Timber use work then consists of mapping and cruising timber; preparing management plans; appraising and advertising timber for sale; marking timber to be cut; scaling the timber as it is cut; administering timber sales; and, in addition, providing for and administering free use of dead and live timber by local residents, as provided for by law.

Volume of National Forest Timber Use

Fiscal Year	No. timber Sales	Amount cut	Amount Cut	Value cut	Amt. Cut Free Use
		Commercial and cost sales MBM	Land Ex. MBM		
1937	20,340	1,096,950	193,673	\$3,188,672	318 MM
1938	21,916	1,074,916	213,001	3,208,507	301 MM
1939	22,717	1,017,269	273,292	3,375,284	300 MM

2. Forest Fire Prevention and Preparedness.--- The present system of organized forest fire control dates back to 1910 when the disastrous fires of that year brought about recognition of the size of the problem. The activities under this project are of such importance and general application that practically every employee paid from this appropriation, regardless of his assignment, contributes to it in some degree.

Under this project fire prevention is an activity of primary importance. Sustained educational campaigns, locally and on a national scale, are carried on through the employment of all available media, - news items, magazines, house organs, radio programs, motion pictures, lectures, admonitory signs, exhibits, distribution of pamphlets and other literature and by constant personal contact with the resident and visiting public. In this education work all possible support is enlisted from national and local agencies organized in civic, welfare, patriotic and trade fields.

Other activities in fire prevention include: requiring visitors to equip themselves with fire fighting tools; partial or entire closing of areas to public travel during dangerous periods; "fire-proofing" campgrounds; concentration of campers on public campgrounds; at times prohibiting smoking and camping at other than established campgrounds; registering and cautioning tourists; clearing road rights-of-way; and apprehending and prosecuting persons responsible for starting fires.

Controlling forest fires is largely a task of advance systemized preparation. Practically all of the members of the permanent organizations are available for fire control work. In addition, approximately 4,000 men designated "guards" are employed during the fire season and are stationed at strategic points throughout the Forests where they act as lookouts, "smoke chasers" or patrolmen. The lookouts are stationed at points which overlook large areas of forest land. These men are connected by telephone to ranger district headquarters. They watch for fires and notify district rangers or dispatchers of the location of the fires. Smoke chasers are stationed on roads or trails and are also connected by telephone with headquarters, and when fires are reported the smoke chasers are dispatched to the fire. Patrolmen both detect and suppress fires within reach of their patrol routes.

In advance of the opening of the fire season complete plans are prepared, including maps showing areas visible from lookout stations, transportation and communication systems, areas of greatest fire hazard, etc. Fire weather forecasting and rating systems are set up. Organization charts are prepared showing the location of all available man-power, including permanent and temporary employees, road and other construction men, settlers

and ranchers, sawmill and logging camp operators, etc. Such charts also include information concerning tools, equipment, and food supplies which may be needed if large crews are required for suppressing fires. Cooperative agreements are entered into with individuals and with all agencies in the vicinity of the National Forest which may be of assistance in controlling forest fires. Men are selected and systematically trained at pre-season training camps whenever possible, and detailed written instructions are prepared for each member of the force.

3. Forest Fire Suppression.---Fire is an ever-present danger in some portion of the forested area of the country. The great size of the forests in comparison with the relatively small patrolling force, the inaccessibility of wilderness areas, the dry air, light rainfall, the prevalence of lightning in the mountains, and the constant use of fire in the daily life of the people and in industries combine greatly to increase the hazard.

Complete fire exclusion in a forest is rarely attainable, because fires originate from natural as well as human causes. The established protection policy calls for fast, energetic, and thorough suppression of all fires in all locations during possibly dangerous fire weather. The objective demands such planning and execution of attack as will secure control within the first work period or before 10 o'clock of the next morning.

Upon receipt of the report of a fire, the regular organization functions immediately and men are dispatched to the scene. Though each fire-suppression job is an individual problem, there are certain basic principles of attack. The first requirement is usually to learn the size of the fire and determine its probable progress by noting topography, type of cover, wind conditions, dryness of litter, natural firebreaks, etc. Next comes the job of building the fire line where the best judgment of the officers in charge dictates. The line is patrolled to prevent the fire from jumping it. During the construction of the control line and after it has been completed and the fire checked, continual patrol is necessary to prevent it from breaking out again, jumping the line, and going on a rampage. No fire is left until it is completely out.

4. Protection against Tree Insects.---Tree insects are always present in the forest. Natural enemies normally keep down the numbers of injurious species so that damage is not excessive. Sudden epidemic increases occur in populations of barkbeetles and other destructive forms, requiring artificial control measures. Close cooperation between the Forest Service and the Bureau of Entomology and Plant Quarantine insures planning and execution of necessary control measures. CCC and ERA labor and funds are used whenever possible to assist in control. Much of the work is done in remote, inaccessible areas, and sometimes under difficult snow conditions. In such cases emergency funds and labor are quite ineffective because of limitations on expenditures for travel, etc. Local experienced woodsmen are hired in such cases.

Methods used are to locate, map, and treat areas where infestations are building up to epidemic proportions. The effort is to confine attacks to relatively small areas, reduce the numbers of insects, and the infestation to an endemic stage. Vast quantities of overripe timber on the national forests are particularly susceptible to insect damage, necessitating adequate control of epidemics.

Control measures vary with type of insect, its life cycle, and character of the terrain. Chief costs are for employment and subsistence of labor. Barkbeetles - most destructive of the forest insects - are controlled by destroying the immature broods while in the trees, by felling and burning infested trees; by felling the trees, peeling and burning the bark; or by spraying standing trees with oil and scorching the bark. Defoliators are controlled by applying poison sprays to the trees. Crews of temporary laborers work under the supervision of permanent Forest officers.

It is obviously impossible to forecast the extent of the work to be done in any future year, but funds are allotted on the basis of relative needs as they develop during each fiscal year. Past records show the following acreages treated:

<u>Calendar Year</u>	<u>Acres treated for Insect Infestations</u>
1936	1565,639
1937	434,840
1938	624,937

5. Control of Blister Rust and other Tree Diseases.--Native tree diseases are responsible for extensive timber losses but the most serious diseases on the national forests have been introduced from foreign countries. White pine blister rust is at present the outstanding disease threat in the national forests.

Control of this scourge may be accomplished by the use of measures developed by the Bureau of Entomology and Plant Quarantine with which the Forest Service cooperates closely. Technical direction of blister rust control on national forest land is supplied by the Bureau of Entomology and Plant Quarantine; the Forest Service handles the control operations. On other lands both phases are directed by the Bureau of Entomology and Plant Quarantine. Eminently satisfactory progress has been made by the two Bureaus in keeping their programs properly balanced with respect to control work on national forest and intermingled private lands.

Some forest diseases may be controlled by vigorous attack in the early stages of infection, to prevent epidemics. In the case of blister rust, the problem is simplified because the disease is of the dual host type. Spores from pine trees do not reinfect pine, but must pass through a stage on the leaves of Ribes (currants and gooseberries), where other spores develop, which are borne by the wind to nearby pines. Control is accomplished by removing the Ribes in and near pine stands. Most of the work is done by pulling the bushes by hand, although in some cases chemical control, by spraying, is possible. Dense thickets sometimes eliminated by

bulldozers. Laborers must be housed in camps in much of the territory where control is necessary. All work is checked painstakingly in order to be sure that no bushes are missed, but repeat treatments are needed on most areas after a lapse of two to four years, in order to destroy bushes which have grown back from seed.

6. Timber Stand Improvement.-- Timber stand improvement consists of the removal of undesirable growth from the forest in order that the remaining trees may benefit by increased light and growing space and grow more rapidly, produce better quality lumber. On those portions of the national forests where it is practicable to practice intensive forestry, better future values may be obtained by cleaning very young stands, that is, removing competing inferior "forest weeds" and poorly formed stems of better species; by thinning over dense young to medium aged timber stands; by releasing from competition and pruning the lower limbs of selected crop trees; by felling or girdling unmerchantable holdover remnants of the former stand which tend to suppress and kill thrifty young trees; and by other methods.

Poor, diseased or insect infested trees are removed, leaving the better formed thrifty individuals for future growth. Where local markets permit, such work is done through commercial sales or under free use permits, but lacking a demand for fuelwood or other low value products, and when the removed material is too small to utilize, cultural operations are done by CCC, ERA, or hired crews of local laborers. At present, however, expenditures for this project consist largely of general and direct supervision of crews paid from emergency funds.

7. Reforestation and Revegetation of Denuded Areas.-- 3,360,000 acres of national forest land need planting. The first national forest planting was done in 1902, and there are now 814,867 acres of satisfactory plantations.

Areas planted and sown on the national forests in recent years:

<u>Calendar Year</u>	<u>Acres</u>
1932	24,755
1933	69,215
1934	74,716
1935	140,724
1936	223,075
1937	156,427
1938	155,164

Forest fires, destructive logging, and exhaustive agricultural use (of submarginal land) are responsible for the areas which must be planted to restore productivity. In western national forests much of the denuded land was burned before the forests were created, some has burned since that time. In the Lake States, Northeast and South, millions of acres have been purchased for national forests, including much land which had been devastated by destructive logging and repeated fires. Smaller areas of these national forests are in critical condition because of former misguided agricultural use.

Reforestation is done to improve watershed conditions, particularly on areas which supply water for municipal and domestic use; to control and prevent erosion; and to grow commercial crops of timber, which will provide, or increase, future opportunities for labor in connection with harvesting the forest products produced.

Planting is a seasonal job, and provides work for comparatively large numbers of laborers during the spring and fall seasons when weather conditions are favorable for the work.

Planting areas are selected carefully and the trees, of species and size suited to the site, are planted individually by crews of laborers supervised by forest officers. A large part of the actual planting work is done by CCC and other emergency labor, otherwise the annual program would be necessarily much smaller. Studies of specifications for planting stock, methods of training planters and systems of planting, constantly in progress, have increased production and survival.

8. Nurseries and planting stock.-- A technically trained nurseryman is in charge of each of the 26 nurseries in which seedling and transplant trees are produced for national forest planting. Trees from one to four or five years of age are required, age class and size depending on species of tree and condition of the planting site.

Nurseries vary in size, depending on annual production and the age class of trees grown. Transplant stock requires much greater space than is needed for producing seedlings. Each nursery is equipped with a nursery office, workshops, implement houses, and water system for spraying the growing trees. Many have a residence for the nurseryman, planting stock storehouse, and seed extractory buildings. Temporary laborers are employed during the growing season and also the shipping season. Nursery work includes extracting, cleaning and storing tree seed; preparing, sowing, weeding, watering seedbeds; transplanting; watering, cultivating and weeding transplants; lifting, grading and packing trees for field planting; and maintaining soil fertility by means of fertilizers and soiling crops.

List of Forest Service Nurseries producing Forest Tree Seedlings and Transplants primarily for Planting National Forest Land

<u>State</u>	<u>Nursery</u>	<u>1938</u>	
		<u>Production</u> ^{1/}	<u>Approved annual output</u> ^{2/}
		(1,000 trees)	(1,000 trees)
Arkansas	Ozark	1,370	2,900
Arizona	Le Roux Spring	..	500
California	Durbin	1,255	1,500
Colorado	Monument	5,238	5,500
Idaho	McCall	..	1,000
Indiana	Vallonia	3,386	8,300
Louisiana	R.Y. Stuart	20,237	22,000
Michigan	Beal	4,109	10,500
"	Wyman	11,297	26,300
"	James W. Tuomey	6,968	12,600
"	Chittenden	13,207	19,000
Minnesota	Lydick	4,596	8,000
"	Eveleth	3,284	7,150
"	Knife River	1,650	2,650
Mississippi	W. W. Ashe	18,176	20,000
Missouri	Licking	4,343	3,750
Montana	Savenac	6,800	10,000
Nebraska	Bessey	5,549	6,000
Ohio	Chillicothe	513 ^{3/}	..
South Carolina	Enoree	575	1,780

1/ Number of trees produced in any given year may vary considerably in any nursery from the approved production because of unexpected losses, shortage of funds and other reasons. Nurseries with no 1938 production are new and no trees reached shipping age in 1938.

2/ Based on need for planting in the area served by each nursery, and on available funds. Could be increased materially in most cases, if more funds were available.

3/ Nursery being abandoned.

List of Forest Service Nurseries producing Forest Tree Seedlings and Transplants primarily for Planting National Forest land - continued

State	Nursery	1938	Approved annual output
		Production ^{1/} (1,000 trees)	^{2/} (1,000 trees)
Utah	Toney Grove	..	2,000
Washington	Wind River	4,010	3,500
W. Va.	Parsons	2,266	5,000
Wisconsin	Hayward	7,193	13,300
"	Butternut	2,100	11,400
"	Hugo Sauer	10,500	10,300
Wyoming	Pole Mountain	403	280
Total - - - - -		139,105	215,210

^{1/}, see preceding page

^{2/}, see preceding page

9. Grazing Use.— Work carried on under this activity is both administrative and technical. Administrative activities have to do with the coordination of domestic livestock forage uses with wildlife, recreation, timber production and protection, and other uses of the national forests. All livestock grazed are covered by formal permit excepting the few head permitted free to settlers, miners, or prospectors, or those used in connection with permitted operations. The latter permits sometimes involve relatively more work than the larger, more formal transactions and sometimes require written permits. More than 11,000,000 pay and free stock, which include the season's natural increase, were grazed in 1938.

Other work consists of the handling of grazing applications for pay permits, stock counting, inspections to determine range readiness and to see that management on different units of range is installed and carried out during the grazing season, studies of those uses in relation to local capacities, supervision of improvement construction such as fences, water development, stock bridges, driveways, and stock trails, poison-plant eradication, handling of complaints and appeals, meetings with stockmen and advisory boards, preparation of annual and periodic reports, and the development and current revision of unit management plans. New trespass cases during 1938 numbered 255; over 3,800,000 acres were covered by intensive range surveys; poisonous plants were dug on 1,867 acres; 17 new livestock associations were perfected; bringing the number to 768 and assistance was given on more than 780,000 acres for rodent control.

10. Recreation and Land Use.— The work carried on under this activity includes the planning, control, and administration of all forms of occupancy of national forest lands except only those relating to the use of the forage and timber resources. General surveys of entire national forests are made in order to determine and classify areas suited to each specific use. Because of conflicting demands of various types of uses, careful surveys and planning for each are necessary. The areas that are classified as being suited to recreational use require further surveys and plans in order to determine the specific type of recreational use to which they are best adapted. Careful planning is necessary because the designation of areas as special use areas, suited for resorts, summer

homes, clubs, etc., or for public campgrounds, or for wilderness areas, constitutes, in many instances, a permanent dedication to that use.

The work involved in administering the special use business of the Forest Service includes negotiations with prospective permittees, showing them the available sites, issuing permits, the drawing up of minimum requirements, plans, and specifications for each special use area; review and approval of improvement plans of new permittees, according to the area in which the use is located; making up permits, preparation of letters of transmittal for handling the fees, and inspection of areas for compliance with clauses made a part of the contract or special use permit.

Particularly in Regions 7, 8, and 9 the forest tenancy problem is acute and involves thousands of impoverished families. These people were tenants on the land before it was purchased and it would be a serious matter to remove them. Their removal would serve to complicate the social and relief problems in adjacent areas.

The work consists of rehabilitating them to the extent that they can make a living on the land supplemented by work on the forest. The first consideration is to make their homes weatherproof and their water supply sanitary. Then in order to protect the land, farm plans are prepared and compliance checked. Erosion control of tilled lands is secured through terracing and proper crop rotation.

A great deal of study is necessary to revise forest work plans so as to provide as much forest employment as possible for these people. Work provided to these occupants must be integrated with other emergency work programs.

On each special use area it is necessary to survey out each lot, locate each road and service drive, and set stakes on each lot for building locations. On the public use areas it is necessary to plan the entrance drives, camping areas, campground facilities, parking areas, playgrounds, beaches, etc.

Within each specific area it is necessary to determine whether the entire area shall be dedicated to special use and become available for summer homes, clubs, or resorts, or a combination of two or more of these uses, or whether the entire area shall be dedicated to public use and developed as a public campground, or whether it shall be kept primitive. It might be finally decided that a specific area should be developed so that a portion would serve as a campground, another portion as a summer hotel or resort site, still another portion as sites for summer homes. All these decisions must be based upon surveys and plans.

On public campgrounds, used free of charge by the public, policing is required to assure proper use and maximum utility by the public. On a majority of the public campgrounds this duty is assigned to a regular or temporary seasonal employee of the Forest Service in conjunction with their other duties. On the larger campgrounds it is necessary to assign men as caretakers for the entire camping season. On many of these areas

policing, garbage-disposal provisions, and furnishing firewood requires the services of more than one man.

Additional work carried on under this activity includes the landscaping of ranger stations and other administrative buildings, checking forest road locations prior to construction with particular regard for the preservation of scenic and recreational values, and checking designs of all structures erected in the national forests from the viewpoint that their appearance will be appropriate in a forest setting.

11. Land Classification, Settlement, and Claims.— The lands reserved for national forest purposes from the public domain are subject to the provisions of the Forest Homestead Act of June 11, 1906, and the Classification Act of August 10, 1912. These Acts require the determination, classification, and listing of all lands chiefly valuable for agricultural purposes and not needed for more important public purposes. The original work of classification was completed a number of years ago, but need for revision, amendments, and readjustments arises intermittently and requires administrative action. Lands listed and entered under these laws require periodic supervision, and preliminary to application for patent, reports must be made for the Department of the Interior. The national forest lands reserved from the public domain also are subject to the general mining laws of the United States and to the public-land laws relating to rights-of-way, easements, etc., in which cases the Forest Service acts as the field representative of the Department of the Interior, preparing the necessary reports and conducting the required supervision of the development work. There are tens of thousands of mining locations within the national forests and scores of applications for easements, rights-of-way, etc., which require attention each year.

The principal purposes of this activity are to insure (a) that the lands chiefly valuable for agricultural purposes are properly classified and made available for entry, (b) that all the requirements of the public-land laws are satisfactorily met, and (c) that use and occupancy under such public-land laws do not result in illegal or unjustified conflict with the protection and use of the national forest lands and the public interests inherent therein. The activity entails the use of the time of personnel on the work of field examination, the determination of fact, the preparation of reports, the presentation of evidence in cases of violation of legal limitations, and administrative routine in relation thereto. Proper control of mineral locations requires in itself the permanent employment of two technically qualified mineral examiners in addition to the part-time service of numerous forest rangers and other members of the field organization.

12. Acquisition of Land by Direct Purchase.— This project includes only the time and expenses of rangers and other regular employees paid from this appropriation while engaged on this activity incidentally to their other duties and generally in a supervisory capacity. The acquisition of land by direct purchase has been financed each year since 1911 by a special appropriation or emergency allotment. In the Agricultural Appropriation Act for 1940, the amount appropriated for this purpose was \$3,000,000. A detailed description of this activity will be found under the caption, "Acquisition of Lands for National Forests."

13. Acquisition of Land by Exchange.— Within the national forests of the United States there are an estimated 25,000,000 acres of land not vested in Federal ownership, consisting of grants to States and to railroads, various types of entry and lands patented under the general land laws of the United States and the Forest Homestead Act of June 11, 1906. These lands, being widely interspersed among the Federal lands within the forests, complicate and increase cost of protection of the national forest properties, and in many cases not only retard the proper management and utilization of the Government's holdings but constitute fire hazards for adjoining national forest lands. There are also many other forest lands outside of the established national forest boundaries but contiguous thereto which are integral parts of the same natural unit of forest management in which the public interest can be promoted by bringing such lands under Federal management and protection. In recognition of this condition Congress has passed a total of 74 laws permitting the acquisition of privately owned forest lands in those contiguous areas by granting in exchange not to exceed an equal value of national forest land or stumpage within the same State.

The acquisition of forest land by the exchange medium serves the multiple purpose of bringing natural units of forest management under approved plans or programs of management and use; of eliminating or minimizing conditions of abnormal risk or hazard on private lands which might ultimately result in serious damage to contiguous Federal holdings; of establishing unified areas of national forest lands which can be administered with a minimum cost; of providing for optimum development of the resources of the area, and promoting the conservation of the natural productivity and esthetic and social values of such lands, making it possible to apply their benefits to the general welfare of the communities within and adjacent to national forests. The acquisition of land by the exchange medium also frequently makes it possible for the Government to cooperate with owners of large scattered tracts to consolidated their lands, thereby permitting them to establish more unified areas, with resultant benefits of better management and use of their lands. The exchange project has been very beneficial to the Government in consolidating its lands when appropriations for land by direct purchase are not sufficiently large to meet the needs of the Government in acquiring very desirable key tracts in certain areas.

The conduct of this activity involves the receipt of applications for exchange; the examination, mapping, cruising, and appraisal of the offered land to determine the maximum values which may be allowed therefor; the comparable examination, mapping, cruising, and appraisal where necessary of the Government lands to be selected in exchange, or of terms of exchange with the owners of the private land; the preparation of the necessary reports for review by the various executive officers and by the Secretaries of Agriculture and the Interior or their staffs; and the subsequent transaction of the successive routine steps necessary to consummate the exchanges and deliver the national-forest lands or stumpage. During the fiscal year 1939 there were submitted to the Secretary of Agriculture, for approval and transmittal to the Secretary of the Interior, a total of 120 cases involving an aggregate of 216,096 acres of private land, valued at \$1,675,260; selected areas containing 35,668 acres and valued at \$49,739, and selected

national-forest stumpage, valued at \$1,221,958. Initiation and consummation of these exchanges required or will require the performance of all of the above cited functions.

To date the lands acquired through exchange by the United States have supported about twice as much stumpage of merchantable character as has been granted for such lands in the form of stumpage. The stumpage acquired will in time become salable and yield receipts to the Treasury. To acquire such private lands and stumpage it is necessary to grant more accessible national-forest stumpage, some of it within the limits of going timber sales. While the stumpage so granted would otherwise be salable for cash, some of it would not normally be salable for a considerable future period, because the parties to the exchange are the only ones that could use such stumpage in the future, and they would not be willing to acquire it by cash purchase, although they are willing to acquire it by exchange.

14. Fish and game.— Work under this head consists of cooperation with various Federal, State, sportsmen and other agencies, cooperation in the enforcement of State and Federal game laws, examination of licenses and their issuance in remote places where the public cannot be otherwise effectively served, the giving of information to the public about game laws and wildlife, the requisition and planting of large numbers of fish and the development of fish planting plans, posting game refuges and other protected areas, transplanting beaver, assistance in transplanting game birds and in predatory—animal control, the making of game estimates and the collection of statistical information on species and on game animals killed by man and by predators, the relation in season to game laws and bag limits, inspection and selection of sites for holding and rearing ponds, development of plans for restocking of lakes and streams, supervision of lake construction and stream improvements, game bird surveys with special observations on species threatened with extermination, winter observations on range adequacy for big game and condition of animals, studies of sex ratios, forage requirements, assistance in emergency feeding during critical periods, the study and correlation of wildlife and domestic stock uses, over-populations, public hunts, and the development of game management plans.

15. Construction of truck and horse trails.--Most of the national forests are located in sparsely settled sections of the country and were largely undeveloped and inaccessible when acquired. The major costs of the work on truck and horse trails are borne under the appropriations "Roads and Trails for States, National Forest Fund" and "Forest Roads and Trails". The work under this specific project includes the time and expenses of the employees paid from the appropriation "National Forest Protection and Management", in planning for and supervision of the truck and horse trail construction program, incidental to other regular duties. The special road appropriations provide for the direct costs of labor, materials, supplies, and direct supervision.

16. Maintenance of truck and horse trails.--The direct costs of maintenance are borne by the Forest Road and Trails appropriations. However, a great deal of time is necessarily spent by the regular personnel principally rangers and supervisors in planning, coordinating this project with other activities and supervising the work. These tasks are incidental to other regular duties. The scheduling of this work is very important, inasmuch as all roads must be opened in advance of the fire season.

17. Construction of improvements other than roads and trails.---Most of the national forests are located in the mountainous regions of the country, largely undeveloped and inaccessible. To facilitate their administration and protection it is necessary to equip them with various classes of improvements.

Telephone lines are needed for fire control in localities where commercial systems are not available, lookout cabins on mountain peaks to house men, and instruments properly located to discover lightning and other fires and to transmit the alarm; lookout towers where the topography does not provide a natural elevation sharp enough to command the necessary view; dwellings, barns, and other structures necessary to provide quarters for men and animals who must be stationed remote from any settlement or rentable quarters; simple office structures for housing records and transacting business required in administrative or fire-control work; fences to prevent the trespass of unpermitted stock or to control the drift of permitted stock in order to secure the best utilization of the national-forest ranges; water improvements in the form of developed springs and wells, pipe lines, and other works required at ranger and other stations, or for watering livestock on the forest ranges, or for public campgrounds; and other campground improvements designed to protect the forests, maintain sanitary conditions, and facilitate public recreational enjoyment of the forests by providing simple structures, etc.

There are also required certain improvements of a nonstructural nature, such as permanent firebreaks and lanes placed in strategic locations to facilitate holding fires that escape from the initial efforts to control them; the clearing of debris and fallen timber along roadsides to reduce the fire hazard; the improvement and cleaning of fishing streams; and soil-erosion work.

Each national-forest region has a plan for its improvement needs. As funds are made available, those of highest priority are constructed along standardized specifications and simple practical lines.

18. Maintenance of improvements other than roads and trails.-- This project includes the repair and maintenance of all forms of improvements except roads and trails. The thousands of miles of telephone lines are thoroughly gone over; fallen trees are removed; broken wires are spliced; insulators are replaced and instruments are checked. The wear and tear on buildings and lookout towers in forested country is great. Lightning insulation is repaired, windows are replaced, and guying, painting, roofing, etc., are attended to. Fences are put into shape by post replacement, guying, and wire repair. Springs, troughs, tanks, basins, and piping are cleaned and repaired. Public campgrounds are cleaned up and put in shape, and fire preventive safeguards are freshly overhauled.

19. General Surveys and Maps.--A greater and more intensive utilization of the forests, the addition of new forest areas, or changes in boundaries of forests for purchase units require markings of property lines, surveys and maps for laying out transportation, detection and communication systems, special-use and recreation areas, nurseries, administrative stations, lookout towers, water-resource utilization, type mapping, and property ownership. Corrections of existing maps must be secured to make these suitable for Forest Service administration and protection. Some 75 forest maps must be corrected, traced, lithographed, and printed. More accurate locations of topographic and cultural features are required for the proper protection and administration of the forests. Aerial photographs and maps are being obtained of forests where desired because of their value not only for mapping topographic and cultural features but also for delineation of boundaries of types of forest cover, grazing areas, and in connection with fire detection and suppression, and in planning of flood control and other projects. The Forest Service is not engaged in general quadrangle mapping like that of Geological Survey, in township and sectional surveys like the work of the General Land Office, or upon control surveys similar to those of the Coast and Geodetic Survey. However, where any topographic, cadastral, or control work is done the standards used permit adoption and incorporation with the later work of the other agencies.

20. Cooperation with other Departments, Bureaus and Agencies.-- The Forest Service cooperates with other Government departments, bureaus, and agencies on activities not primarily of benefit or producing benefits to national-forest resources. Often the Forest Service is better qualified to carry on such work because of the technical experience of its personnel or because the geographic distribution of its organizations may enable it to better handle the work from the broad viewpoint of Government economy. This work is done in accordance with the standards established for the various jobs. Illustrative of this work project is the cooperation with the Bureau of the Census in their agricultural and lumber censuses; cooperation with the National Park Service, the Bureau of Indian Affairs, and the War Department regarding forestry problems on

their lands; cooperation with the Department of Justice and the Treasury Department in law enforcement where national-forest lands are involved, etc.

21. Hazard reduction, fire prevention and timber use, White Mountain National Forest.--The \$500,000 provided by the First Deficiency Appropriation Act of 1939 is being expended for hazard reductions along roads and trails which existed prior to the hurricane of 1938, some added fire breaks at strategic points, developments of water holes, the employment of an enlarged force of fire guards, the purchase of an adequate supply of fire tools and equipment, and timber salvage. Timber salvage operations have been confined to the removal of logs in fire lanes, trails and roads where hazard reduction work has been conducted.

EMERGENCY FUNDS

Projects	Obligated, 1939	Estimated obligations, 1940
<u>Emergency Relief, Agriculture, Forest Service</u> <u>(Transfer from W.P.A.):</u>		
For expenses in connection with projects under "National Forest Protection and Management" , as follows:		
Timber use	\$18,990	\$9,300
Forest fire prevention and prepared- ness	144,593	143,556
Protection against insects	130,184	121,272
Control of blister rust and other tree diseases	271,397	243,000
Timber stand improvement	52,666	49,500
Reforestation and revegetation of denuded areas	109,433	105,000
Nurseries and planting stock	67,670	67,691
Grazing use	20,045	12,400
Recreation and land use	55,327	10,300
Land classification, settlement and claims	1,055	..
Acquisition of land by direct purchase	14,228	..
Acquisition of land by exchange	4,220	..
Fish and game	22,536	5,100
Construction of improvements other than roads and trails	1,680,126	1,588,679
Maintenance of improvements other than roads and trails	584,595	427,000
General survey and maps	53,058	..
Total for foregoing projects	3,230,123	2,782,798
Administrative funds included above	168,423	63,908
Net project funds	3,061,700	2,718,890

(c) RECONSTRUCTION AND REPAIR OF ROADS AND OTHER
IMPROVEMENTS, NATIONAL FORESTS IN CALIFORNIA

Under the above title an appropriation of \$1,000,000 was provided by the Second Deficiency Appropriation Act, 1938 (approved June 25, 1938), for the reconstruction and repair of flood-damaged roads and other improvements on California National Forests. The entire appropriation was obligated during the fiscal year 1939.

(d) WATER RIGHTS

Appropriation, 1940 \$20,000
 Budget Estimate, 1941 20,000
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PROJECT STATEMENT

Projects	1939	1940 (Estimated)	1941 (Estimated)
Investigation and establishment of water rights	\$19,371	\$20,000	\$20,000
Unobligated balance	629	--	--
Total appropriation	20,000	20,000	20,000

WORK UNDER THIS APPROPRIATION

For administrative and recreation areas, stock watering and similar uses, the Forest Service needs the right to appropriate and use water. While the amount for an individual diversion or storage is usually small, the number of such uses is very great. Through utilizing appropriations already made, the necessary water right has been secured for a portion of the most urgent cases particularly those in the Colorado River drainage where the suit instituted by Arizona may result in the permanent adjudication and decree of all the water in that drainage and deprive the United States of water rights vitally indispensable to the proper administration and utilization of the National Forests. The \$20,000 appropriation provided by this item is used for a determination of the location and amount of existing utilizations, the making of engineering surveys, the preparation of applications to the proper State authorities, payment of filing fees, securing permits and for the purchase of existing water rights or decrees. Several more years will be required before existing uses of water, particularly in the Colorado River drainage, are adequately protected.

(e) FIGHTING FOREST FIRES

Appropriation, 1940 \$100,000
 Budget Estimate, 1941 100,000
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PROJECT STATEMENT

Projects	1939	1940 (Estimated)	1941 (Estimated)
1. Fire suppression.....	\$2,457,969	\$ 67,000	\$ 67,000
2. Protection of unappropriated public forest lands	114,499	33,000	33,000
Unobligated balance	7,532	--	--
Total appropriation	2,580,000*	100,000**	100,000

*Includes \$2,480,000 forest fire deficiency provided by the Second Deficiency Appropriation Act, 1939.

**Regular appropriation; does not include 1940 fire-fighting deficiency.

WORK UNDER THIS APPROPRIATION

1. Fire Suppression. -- This project covers emergency fire control expenditures in connection with the suppression of forest fires on the National Forests. Administrative restrictions placed upon the use of these funds by the Forest Service provide that expenditures shall not be made therefrom until forest fires have actually started. An exception is made to this rule, however, when fire conditions become so critical that the regular protective organization, which is financed from the appropriation "National Forest Protection and Management", is unable to cope with the situation and when, therefore, the temporary employment of additional guards clearly will reduce expenditures for fire fighting.

Expenditures are made for the employment of fire fighters and their transportation, and for equipment needed on going fires when not available in stocks of equipment previously purchased. Expenditures are made for the travel expenses of forest guards when going to or returning from fires and for the travel expenses of regular employees of the Forest Service when the travel extends beyond the boundaries of the units to which they are regularly assigned, or when the activities to which men are regularly assigned do not include fire fighting.

2. Protection of Unappropriated Forest Lands. -- Unappropriated public forest lands are widely scattered throughout the entire West. In many cases protective associations, organized to protect privately owned lands, and certain states were compelled, prior to fiscal year 1938, to protect the public forest lands intermingled with the private lands. Under cooperative arrangements which have been worked out between the Forest Service and the timber protective associations and States, the Federal Government will now bear its fair share of the cost of protecting these public lands. The accounts of these cooperatives will be audited by the Forest Service and the per acre cost of protecting the public forest land will be based upon a total figure from which all improvement and development expenses have been eliminated.

In addition to the lands within the boundaries of timber protective associations, there are large areas of unappropriated public forest lands which should be protected from fire. None of the lands outside organized protection areas are being protected at the present time, but studies are under way, and there is a probability that fire control programs will be initiated on those areas where protection can be given at reasonable costs.

(f) PRIVATE FORESTRY COOPERATION

Appropriation Act, 1940	\$100,000
Budget Estimate, 1941	<u>100,000</u>

PROJECT STATEMENT

Project	1939	1940 (Estimated)	1941 (Estimated)
Cooperation with timberland owners	\$ 97,453	\$100,000	\$100,000
Unobligated balance	2,547	--	--
Total appropriation	100,000	100,000	100,000

CHANGE IN LANGUAGE

The words "Federally-owned lands leased to States and to" have been added to the language of this item in the estimates for 1941.

This will make it possible for the Forest Service to meet custodial and administrative responsibilities in connection with the various land utilization projects being turned over to the various States by the Federal Government.

By the Secretary's memorandum of December 20, 1938, certain bureaus were designated as custodial agencies for project property acquired by the U. S. Government in connection with the land-utilization program under Title 3 of the Bankhead-Jones Farm Tenant Act. The Forest Service was designated as the custodial agency for 38 of these land-utilization projects in 19 States, covering approximately 650,000 acres. These projects are to be made available to various State agencies under lease or cooperative and license agreements between these agencies and the Department. Under this plan the Forest Service must organize the work of this program and perform inspectional and advisory services to insure proper handling of the various areas by the States.

The custodial agency is, in general, responsible for initiating or taking action on behalf of the Department to assure the fulfillment of the objects of the projects and the terms of the agreements with the State agencies. The custodial agency must be familiar with the nature of all easements, right of way, license, and outstanding interests on the property; also initiate or take such action as may be appropriate in this connection for the full protection of the interests of the United States.

WORK UNDER THIS APPROPRIATION

The industrial forest production involving forest products of all descriptions, must come largely from that portion of the forest lands which are designated as "commercial", totaling some 460 million acres, of which nearly 75% is in private ownership. By and large the 120 million acres of this land in public ownership are considered to be under good management; of the balance, 202 million acres are in nonfarm ownership and 138 million acres in farm woodlands. The intermingled and complex pattern of ownership, however, often makes it imperative that these lands be managed on a coordinated basis, regardless of who owns them. This is especially true when consideration is given to the maintenance of permanent communities and permanent payrolls.

Between 90% and 95% of our forest products are now being removed from the forest lands privately owned. Their maintenance in a productive condition, therefore, becomes a paramount objective of any National Forestry program.

For the past two years the Forest Service has had available the sum of \$100,000 per fiscal year for the purpose of encouraging the practice of forestry on privately-owned lands and for cooperation with forest products industries in the development of markets and for the consideration of obstacles, legislative or otherwise, retarding development of those markets. Prior to this two-year period, sporadic efforts had been made to accomplish these same results.

While it becomes difficult to apply a yardstick to results obtained on an activity of this nature, it can be definitely stated that results on the ground are accruing through close cooperation with operators in analyzing their own forest problems, and it has been found possible to secure definitely improved forest practices in such cases. In some cases sustained yield management has been attained; in others, the land is being left in a highly productive condition as a direct result of our efforts although present production may still be too high. For example, the largest owner of ponderosa pine and allied

species on the west coast has within the past year so changed his method of operation as to make his cutover lands compare very favorably with those on the National Forests. Representing some 8 billion feet of stumpage and being looked to as a leader in his section, the effects of this change in policy are indeed far reaching. Many other similar examples can be cited.

A recent careful estimate of the condition of privately-owned commercial forest land in the Continental United States indicates that nearly 70 million acres are now under reasonably good forest practices, which is better than 20% of the total. While it is not assumed that all credit for this advance is due to the expenditure of the \$200,000 mentioned, a considerable portion of this acreage has been placed under improved practices in recent years, and much of the impetus has come from the cooperative efforts of the Forest Service with the private owners and other organizations.

However, there still remains 80% of the total commercial privately-owned land and 86% of the nonfarm privately-owned land which should be brought under forest management.

As a corollary to the forest practice aspect, it is likewise exceedingly important that the Forest Service cooperate to the highest degree with forest products industries on the problems which face those industries and tend to restrict their markets. It would be of little avail commercially to grow an added volume of timber unless there is to be a market for that timber when it matures. This effort becomes involved in the complexity of relationships between Government and industry. For example, an intensive understanding and clarification of the wage and hour laws, excise taxes, import duties, export regulations, tax policies, maritime regulations and rates, etc., are all involved.

All of the above efforts must be prosecuted over the many varied forest regions of the Nation. In effect the activity becomes what might be termed Industrial Forest Extension. Dealing as it does with those who are active in removing 95% of the forest growth, it is distinctly an activity of first importance in the whole forestry situation.

Forest Research Funds

(g) FOREST MANAGEMENT

Appropriation Act 1940	\$613,403
Transferred in 1941 Estimates from	
"Tropical Forest Experiment Station"	30,000
Total available, 1940	643,403
Budget Estimate, 1941	607,900
Decrease	<u>35,503</u>

PROJECT STATEMENT

Projects	1939	1940 (Estimated)	1941 (Estimated)	Increases or decreases
1. Silvicultural investigations...	\$307,058	\$288,179	\$269,776	-\$18,403(1)
2. Mensuration investigations,....	41,406	49,080	49,080	--
3. Forest regeneration investi- gations	89,644	100,575	90,575	-10,000(2)
4. Fire protection investigations	114,071	117,950	107,950	-10,000(3)
5. Naval stores investigations	15,000	17,314	17,314	--
6. Forest genetics investigations	81,088	70,305	70,305	--
7. Additional for administrative promotions	--	--	2,900	2,900(4)
Unobligated balance	136	--	--	--
Total appropriation	648,403	643,403	607,900	-35,503

INCREASES AND DECREASES

The net reduction of \$35,503 in this item for 1941 consists of:

- (1) A decrease of \$18,403 for silvicultural investigations;
- (2) A decrease of \$10,000 for forest regeneration investigations; and
- (3) Decrease of \$10,000 for fire protection investigations.

These decreases will be met largely by reduction of force, both permanent employees and temporary service.

(4) \$2,900 additional estimated for administrative promotions in accordance with the plan to be uniformly applied in the Budget Estimates for 1941.

WORK UNDER THIS APPROPRIATION

General. -- The research carried under this appropriation is concerned with the problems of establishing and growing forest crops on forest land, whether in private or public ownership, and of protecting them from fire. Investigations are under way in all the important regions in the United States except in the Great Plains. Work has been started at the Tropical Forest Experiment Station in Puerto Rico under an appropriation in 1940. No work at present is under way in Alaska. In each region where research is carried on emphasis is placed upon the most pressing and urgent problems. These investigations are basic to the successful practice of forestry.

Forest-management investigations supply the facts on which sound forestry practices are based. Specifically, they aim to provide the information needed by Federal, State, and private agencies and individuals to enable them to reforest, protect from fire, and manage forest land to the best advantage, to insure an adequate future supply of lumber and other forest products, to increase the quality and quantity of forest products, and to maintain forest cover where needed for recreation and the protection of watersheds and wildlife. Forest management investigations have developed methods, which are being applied on a national scale by the CCC, in stand improvement, reforestation, hazard reduction, and fire control. They have disclosed many of the fundamental principles bearing on the location of lookouts, firebreaks, and roads and trails being constructed on the national forests and the national parks. They have supplied data on reforestation and naval-stores practices to the Agricultural Adjustment Administration and have furnished information on growth, methods of cutting, reforestation, and forest protection to the States and to various other public and private agencies. These investigations furnish information essential to the management and protection of the national forests. The work is being carried out under the following projects:

1. Silvicultural investigations. -- This work includes methods of timber stand improvement, methods of cutting mature timber, and studies of the habits and requirements of seedlings and trees. Because of the great diversity of growing conditions, over 50 major forest types and 180 commercially important forest tree species have to be dealt with. Diversity of ownership and objectives further complicate the problems of forest-land management. Specifically, silvicultural investigations aim to determine how to manage our commercially important forest types so as to insure perpetuation of the more desirable trees, so as to maintain maximum forest production of high-quality products, and so as to obtain a sustained yield. Such information is essential to the proper management of the national forests and is urgently needed by State and private forest land owners if forest cover is to be maintained, watersheds protected, and the country's future need for forest products supplied. This work is now carried on by 13 regional forest experiment stations.

2. Mensuration investigations. -- This project is concerned with growth of trees and stands with particular attention to methods of measuring and analysis of measurements. The project includes the preparation for each of the commercially important forest-tree species of "volume tables" showing the average contents of trees of different dimensions and conditions in terms of cubic feet, board feet, cords and other units; "growth tables" showing the average relation of height, diameter, and volume to age; and, for each of the commercially important forest types, "yield tables" showing the characteristics of the stand at different ages and the yield to be expected under various conditions and methods of handling. There are about 180 forest-tree species and 50 or more forest types of commercial importance in the United States about which such information is needed. Improvements in form and character of such tables and the technique of their preparation and application is an important part of the work. In addition, it is necessary to develop and adapt statistical methods for use in collecting and analyzing data concerning timber cruises and yield-table predictions. From such work has come some of the most fruitful results of the project, in the form of new and more efficient methods of experimentation applicable to many lines of

forest research and improved sampling procedures applicable to the national forest survey and to many other forestry activities. Work is under way on this project at Washington, D. C., and at 10 regional Forest Experiment Stations.

3. Forest regeneration investigations. -- This work involves the further development of methods of reforesting denuded or poorly stocked forest land. It is estimated that there are over 80,000,000 acres of such land throughout the United States in need of planting. Accordingly, it is necessary to determine for each of a large variety of conditions, the species to use and the methods of reforesting to be employed. Nursery and planting problems are studied and the details of the practice determined, and methods of collecting and handling forest seeds are worked out for the many species involved. Direct seeding is studied as to the best method and season for doing it, where it is possible, and the species to use. The regeneration work involves examination of past plantings to determine the causes of success or failure, and studies of seed production and dissemination. Work under this project is now in progress at 11 regional forest experiment stations.

4. Fire protection investigations. -- Work in this field deals with methods of control of forest fires and with the effects of fire. Specifically, studies are being made of how fires start, how fast they spread, of equipment and methods to detect fires, of methods of reducing fire hazards, and of methods of suppressing or fighting fire. Encompassed within these studies are attempts to ascertain relations of lightning, wind, humidity, and other weather factors, topography, and fuel conditions to the occurrence and behavior of forest fires; methods of measuring current fire danger and application of the results to fire control activities; and methods of forecasting fire danger. The effects of fire are studied with particular reference to appraising fire damage. Studies also include methods of controlling certain types of burning useful in hazard reduction and for other special purposes in forest management. Work of this sort is now under way at 8 regional forest experiment stations.

5. Naval stores investigations. -- This work includes methods of turpentineing, and methods of integrating production of naval stores with production of pulpwood poles, sawlogs, and other products from the same timber. Under it are studied the effect of tree size and chipping method on naval stores yield and the effect of weather factors and of fire on the rate and amount of gum flow. In addition, work is done on the effect of turpentineing on tree growth and timber quality.

The naval stores industry has long been important in the South. Early methods of turpentineing were crude and inefficient and resulted in waste of much valuable timber. Research under this project has contributed much toward improvement of these methods. The object of additional work is to further improve turpentineing technique and to feature methods of coordinating turpentineing with timber production for all sorts of products, most of which it is hoped can be produced from trees following a period of turpentineing. This work is under way at the Southern Forest Experiment Station.

6. Forest genetics investigations. -- The segregation or production of desirable strains by breeding, a procedure which has proved invaluable with crop plants, is practically unexplored with respect to forest trees. Work under this project is aimed at the production of trees of higher rates of growth, more resistant to diseases and insects, of better form, and capable of producing higher-quality forest products. This involves the study and segregation of geographical strains and races, studies of the technique of natural and artificial cross pollination and fertilization, experiments in hybridization, investigations of the genetical constitution and transmission of desirable characteristics, field trials of promising individuals and strains, and similar studies. The work is conducted at the California and the Northeastern Forest Experiment Stations.

SUPPLEMENTAL FUNDS

Projects	Obligated, 1939	Estimated obligations, 1940
<u>Emergency Relief, Agriculture,</u>		
<u>Forest Service (Transfer from WPA):</u>		
For projects in connection with research in forest management:		
1. Silvicultural investigations	\$87,852	\$ 95,797
2. Mensuration investigations	3,555	3,877
3. Forest regeneration investigations	16,120	17,578
4. Fire protection investigations	45,310	49,408
5. Naval stores investigations	6,772	7,385
6. Forest genetics investigations	16,009	17,457
Total, supplemental funds	175,618	191,502
Administrative funds included above	6,007	2,915
Net, project funds	169,611	188,587

(h) RANGE INVESTIGATIONS

Appropriation Act 1940	\$245,935
Budget Estimate, 1941	<u>230,900</u>
Decrease	<u>- 15,035</u>

PROJECT STATEMENT

Projects	1939	1940 (Estimated)	1941 (Estimated)	Increases or decreases
1. Grazing management investigations	\$170,580	\$170,717	\$160,782	-9,935(1)
2. Artificial reseeding investigations	39,187	59,218	53,218	-6,000(2)
3. Range forage investigations ..	15,987	16,000	16,000	--
4. Additional for administrative promotions	--	--	900	900(3)
Unobligated balance	181	--	--	--
Total appropriation	225,935	245,935	230,900	-15,035

INCREASES AND DECREASES

The net reduction of \$15,035 in this item for 1941 consists of:

- (1) A decrease of \$9,935 for grazing management investigations;
- (2) A decrease of \$6,000 for artificial reseeding investigations.

These decreases will be met largely by reduction of force, including employees on the permanent roll and by reduction of the amount to be expended for temporary services.

(3) \$900 additional is estimated for administrative promotions in accordance with the plan which is being uniformly applied in the Budget Estimates for 1941.

WORK UNDER THIS APPROPRIATION

General. -- Proper range-management and restorative practices are necessary for the conservation and improvement of the range resource through wise use to assure the stability and economic welfare of the farmers and stockmen producing range livestock and to other dependent related community

and regional interests. This appropriation provides the investigations to furnish the basic technical information of this character so necessary for the administration and handling of the national forests and other ranges, public and private. It is also formulating the methods necessary for range improvement by stockmen, revegetation for flood control, and other range-land phases of the work of the CCC and related projects and range conservation programs. Application of results from these studies has saved stockmen and farmers several million dollars annually. The 900 million acres of forest and un-timbered range land represent nearly half the land area of the United States, and furnishes most of the forage for production of a high percentage of the national supplies of wool, mohair, and meat. These investigations alone can supply the information required for sustained range forage production.

Section 7 of the Act of May 22, 1928 (McSweeney-McNary Forest Research Act) authorizes experiments and investigations under the direction of the Secretary of Agriculture to develop improved methods of management, consistent with the growing of timber and the protection of watersheds, of forest ranges and other ranges, at forest or range experiment stations, or elsewhere. The work is carried on under the following projects:

1. Grazing management investigations. -- This work consists of investigations to develop methods for managing range lands that will assure the stability and perpetuation of range resources, including forage, watershed, timber reproduction, and other range-land values. It involves determination of the grazing capacity of various range types and of ways and means of restoring and maintaining the better forage plants, improving methods of handling livestock on ranges, controlling losses from poisonous plants, reducing the fire hazard by grazing, and harmonizing grazing with other range-land values.

The studies involve the determination of management practices on high summer ranges, mainly on national forests, foothill spring-fall ranges, desert winter ranges, and semidesert year-long ranges. These studies have aided greatly in the better coordination for profitable use of these important forage sources in the year-long livestock operation. They also promise additional results urgently needed by livestock producers and by the Federal and State governments in their plans for permanent land-use and development. This work is now conducted at the six regional forest and range experiment stations in the West.

2. Artificial reseeding investigations. -- Work now under way, being conducted mainly by the Intermountain and the Northern Rocky Mountain Forest and Range Experiment Stations, in cooperation with State Agricultural Experiment Stations and the Bureau of Plant Industry, consists of investigations to develop methods of restoring artificially the plant cover on seriously depleted ranges and abandoned dry farms. It includes also studies to determine what native species justify selection for improvement, the possibilities for adapting native and introduced species for seeding or transplanting, and how they can be most economically reproduced and established on range lands. These studies furnish results of vital importance to owners of range land and to Federal and State agencies in planning programs of range rehabilitation.

3. Range forage investigations. -- Work under this project includes the collection and analysis of information on the identity, distribution, and the forage and watershed protective and other values of over 12,000 plant species which inhabit forest and other ranges throughout the United States--information absolutely essential to good range management. It includes the building up of the most complete annotated working herbarium of range plants in the country, a basic feature in meeting the demands for information incident to these studies. This is a continuing study. Range plants and data are collected by all the administrative and research personnel of the Forest Service concerned with range management. The major compilation and analyses are made in Washington.

SUPPLEMENTAL FUNDS

Projects	Obligated, 1939	Estimated obligations, 1940
<u>Emergency Relief, Agriculture, Forest Service (Transfer from WPA):</u> For projects in connection with range investigations:		
1. Grazing management investigations	\$33,602	\$36,641
2. Artificial reseeding investigations ...	4,947	5,394
3. Range forage investigations	14,559	15,876
Total, supplemental funds	53,108	57,911
Administrative funds included above	1,817	881
Net, project funds	51,291	57,030

(i) FOREST PRODUCTS INVESTIGATIONS

Appropriation Act 1940	\$664,181
Budget Estimate, 1941	668,200
Increase	<u>4,019</u>

PROJECT STATEMENT

Projects	1939	1940 (Estimated)	1941 (Estimated)	Increases
1. Timber harvesting and conversion	\$96,441	\$94,181	\$95,000	4 \$819(1)
2. Forest products statistics .	9,713	10,000	10,000	--
3. Pulp and paper	114,723	114,000	114,000	--
4. Strength of wood	117,272	134,000	134,000	--
5. Seasoning and physical properties	89,716	94,000	94,000	--
6. Chemical composition	66,218	70,000	70,000	--
7. Wood preservation	85,199	99,000	99,000	--
8. Wood structure	49,029	49,000	49,000	--
9. Additional for administrative promotions	--	--	3,200	4 3,200(2)
Unobligated balance	50	--	--	--
Total appropriation	628,361	664,181	668,200	4 4,019

INCREASES

The increase of \$4,019 in this item for research in forest products consists of:

(1) An increase of \$819 to supplement funds now available for timber harvesting and conversion investigations.

(2) \$3200 additional estimated for administrative promotions in accordance with the plan which is being uniformly applied in the Budget Estimates for 1941.

WORK UNDER THIS APPROPRIATION

General. -- The growing of timber for the many products demanded by modern civilization represents the more tangible economic value or use of forest land. A broad and intelligent utilization of our forest resources is therefore an indispensable feature of an adequate national forestry program. The utility value of wood must be maintained and increased. The foundation of efficient utilization is research in forest products.

The better adaptation of wood to modern consumption requirements is a matter of direct concern to consumers, whose proper housing and standards of living are bound up with the satisfactory use of wood products; to workmen, who need the hundreds of millions of dollars in wages furnished by employment in the woods, the sawmills, the pulp mills, and broadly diversified fields of wood construction and manufacture; to farmers and other timberland owners, large and small, seeking market outlets for materials from their vast aggregate acreage of woodlands; to local communities, counties, states, and the Nation, which have a vital interest in stable revenues from forests, forest lands, and successful forest industries. In our National Forests alone, the investment in land and timber and the responsibility for a wise utilization of the products require a broad program of research looking to the broadening and stabilization of markets for forest products.

The bulk of the work in forest-products research is centered at the Forest Products Laboratory at Madison, Wisconsin, with some associated work at forest experiment stations and at Washington, D. C. Since its establishment in 1910 the Laboratory has become the outstanding institution of its kind in the world. Conservative estimates place the annual savings to users and producers, alone through application of Laboratory findings, at a figure at least 100 times the cost of operation. Only a small part of the needed work in forest products has been done. There can be no question of the vital part that forest-products investigations play in the whole forestry program.

The work is done at the Forest Products Laboratory or elsewhere under the authorizations for forest products investigations of domestic woods and of tropical woods specified by Section 8 of the Act of May 22, 1928 (McSweeney-McNary Forest Research Act), which authorizes and directs the Secretary of Agriculture to conduct experiments, investigations, and tests with respect to the physical and chemical properties and the utilization and preservation of wood and other forest products, including tests of wood and other fibrous material for pulp and paper making, and such other experiments, investigations, and tests as may be desirable. The work is conducted under the following projects:

1. Timber harvesting and conversion investigations. -- This work includes costs and returns in logging and milling trees and logs of different sizes; design of logging machinery; selection and grading of lumber; and wood-use development.

Millions of acres of barren cut-over land in the South, the East, the Lake States, and of late in the West, are the result of the general belief among timber operators that maximum returns necessitated felling all trees of the desirable species that would cut out any lumber. The owner of forest land is now learning that practically his only chance of low-cost and high-yield continuous production is to evaluate returns on the basis of analytical data, such as the Forest Service has recently been making available, which dictate removal of the larger trees and leaving the smaller trees for growing stock.

Under prevailing practice the timber left, or that has restocked the cut-over areas, has consisted largely of species less valuable than those removed. To find new uses for these species, based on their best utility values, is a major forestry problem and a feature of this project. Its solution will enable their profitable removal and at the same time improve the forest. Coupled with this is the problem of converting the present 50 per-cent waste in the woods and at the mill into marketable commodities.

Lumber is separated at the mill into classes or grades on a basis of the number, condition, and size of visible defects. Rules for grading have become more and more complicated with resultant difficulties and misunderstanding between manufacturers and users. The Forest Products Laboratory has played a prominent part in various movements to improve and simplify grading rules. Federal specifications prepared by the Forest Service govern the purchase of lumber by the Government.

2. Forest products statistics investigations. -- Information as to the production, consumption, and distribution of lumber and other forest products is essential to the orderly manufacture and marketing of forest products; the maintenance and proper distribution of adequate and suitable supplies of raw material for wood users; and as a basis for planned forest production. These data form the necessary economic background needed by Federal, State, and private agencies dealing with forest, industrial, and social programs and policies.

The work is handled by statistically trained foresters in the Washington Office and at several of the western forest experiment stations. Under a cooperative agreement with the Bureau of the Census, data are obtained from the forest industries concerned by a canvass and are then compiled, analyzed, and published.

3. Pulp and paper investigations. -- This work includes studies of the suitability of various woods for pulps and papers and the development of new and improved manufacturing processes.

The value of pulp and paper products made annually in the United States is, roughly, \$1,300,000,000. The domestic consumption of wood for paper is approximately 10,394,000 cords (about 10 percent of which is imported), valued at \$82,885,000. In addition, wood pulp and paper are imported to the equivalent of about 8,446,000 cords of wood.

The use of wood for pulp far exceeds that of any other raw material and, although the quantity thus used constitutes only about 5 percent of the total timber cut of the United States, it is of large importance by virtue of being a profitable outlet for a class of timber and for wood wastes having practically no other value except as fuel. Furthermore, the removal of much of this material (as thinnings, etc.) is a feature of good forestry.

Looking to the future, making the United States self-sufficient as to pulpwood requirements could mean doubling the national income from pulpwood, with added large values from manufacture, and jobs for 250,000 more persons than were engaged in the pulp and paper industry in 1929.

Definite progress has been made by the constant search for new or modified processes that will enable using woods other than spruce, which now supplies 70 percent of our pulp and paper requirements. As a result of work by the Forest Service and other organizations, much prominence has recently been given in the press to the Southern pines as a possible source of newsprint. This work on southern pine will be continued, as will the work to find a process adapted to pulping Douglas fir, especially in the form of woods and mill waste, of which enormous quantities are available; and also the work to check stream pollution by developing methods of recovery and re-use of waste cooking liquors.

4. Strength of wood investigations. -- This work includes strength and related properties of wood and improvement in design of structures, containers, and other wood products.

Besides its importance to the average citizen and home builder, this project has a vital relation to the utilization of timber and the liquidation of forestry investments. Building construction normally consumes more than 60 percent of our annual lumber production, a large proportion going into small houses. In recent years, however, the use of wood in buildings in comparison with other materials has shown a great decline, chiefly because lumber in construction does not reflect the modern trends toward lower costs in the handling and assembly of other materials.

Improvements in the engineering of wood construction such as are now under study at the Forest Products Laboratory to make possible the building of simple and inexpensive but thoroughly satisfactory wooden houses would mean more desirable homes for families with small resources as well as new life in the construction industry. New developments in heavy timber construction which are now under investigation also promise a great advance in engineering economy. About one-sixth of the total lumber production is used for boxes and crates. Improvements in these and other containers benefit the consumer through their effect on the cost of shipping the products he uses.

This project involves strength tests of the clear wood of all commercially important species, both from virgin and second-growth stands in various forest regions; investigations of factors affecting properties, such as defects, moisture content, and weight; appraisal of the effect of preservative, seasoning, and other processes; and determination of the efficiency of nails, bolts, screws, glues, and other mediums for joining wood members or parts.

5. Seasoning and physical properties investigations. -- This work includes studies of kiln drying, air seasoning, and storage of lumber; of the moisture content of wood in use; of seed-extraction equipment; and of the insulation of buildings.

Improper seasoning methods and poor storage, handling, and construction practices cause losses of more than \$100,000,000 annually. They include the entire loss of certain species which cannot now be seasoned; the loss of footage and value through degrade; and the damage from swelling, shrinking, and warping of fabricated products and structures. The reduction of these losses, in whole or large part, is the goal of the Laboratory's work.

Kiln-drying principles and methods developed at the Laboratory have revolutionized the kiln-drying industry. More than half the kilns built in the United States in the past five years are of the internal fan type developed at the Laboratory.

6. Chemical composition and wood utilization. -- This work includes studies of the chemical composition and utilization of wood; of physical-chemical structure and properties; and the development of improved and new chemical processes and products.

Wood constitutes the largest and most convenient source of cellulose, one of our most important raw materials. Chemical means must be used in isolating the cellulose because the lignin with which it is surrounded resists all other methods. Science confidently looks forward to the conversion of cellulose into other important commodities in addition to paper, artificial silk, fabric, cellophane, lacquers, and plastics for which it is now used. Lignin comprises one-quarter of the wood but, because of its chemical complexity, no method of utilizing it has been devised. It is wholly wasted in the pulping processes. Since both cellulose and lignin must be isolated by chemical means and converted into other commodities by chemical processes, the economic importance of a thorough knowledge of their chemical nature can hardly be overestimated.

The chemical composition of wood substance, the arrangement of constituent parts in the wood cell, the size and spacing of the cells, and the variation of all such characteristics according to species and growth conditions are intrinsic factors which determine the useful properties of wood in mass. The aim of this project is to attain a scientific understanding of these factors, which is essential to the best results in growing the wood, in its selection, its seasoning and handling, its impregnation with preservatives, its use in construction, and its conversion into pulp and other products. The work involves the conversion of wood waste into wood-distillation products, grain alcohol, plastics, and other useful materials.

7. Wood preservation investigations. -- This work includes studies of wood treatments to increase resistance to decay, insects, and fire; and of coatings, paints, glues, and laminated construction.

Rail transportation costs depend to a considerable degree upon economy and efficiency in the use of wood for railway ties, bridges, poles, piling, and other construction. The railroads use nearly one-fifth of the total annual lumber production and spend over \$100,000,000 per year for wood and much larger sums for its treatment and installation. Preservative treatment has greater influence than any other factor in reducing annual costs for wood used by railroads. Likewise public-utility costs are influenced by the efficiency obtained in the use of poles and other wood in the distribution systems.

Fire losses in wooden structures constitute an enormous loss that can be reduced by the discovery of cheap and effective fireproofing methods. The cost to home owners of maintaining the paint on their property is estimated at \$375,000,000 annually. The strength and durability of glue joints have a

profound influence upon the service given by glued products, for which the public pays about \$1,000,000,000 per year. Losses from defective gluing are heavy. The performance of wood in floors, furniture, house trim, aircraft, and numerous other uses is impaired by shrinking and swelling with moisture changes, the prevention of which is of the highest importance in maintaining markets for wood. The work under this project is largely of direct value to the consumer.

The work involves experiments to improve wood preserving processes; service records of treated material subjected to conditions of actual usage; records of the lasting qualities of various paints applied to wood panels of different species and exposed in various regions; tests to determine the fire resistance of both small pieces subjected to fire-resistant treatments and of full-sized structural units; and the improvement of glues and gluing methods.

8. Wood structure and growth investigations. -- This work includes the microscopic identification of wood; and studies of the relation of growth conditions to wood quality, the relation of structure to properties, and the formation of resin.

Knowledge of wood structure is essential in identifying the thousands of wood and pulp samples submitted by Government officials and the public. Such identifications aid in selecting the right kind of wood for a given purpose in adjusting disputes between buyers and seller, and many times have proved very helpful in criminal cases involving wood.

Knowledge of the relation of growth conditions and structure to properties makes it possible to overcome trade prejudices and to broaden the uses of wood, to safeguard the public against defective material, and thus to increase the value and efficiency of wood in service. The information obtained is of value in selecting species for reforestation, in the profitable use of marginal agricultural lands and overflow lands for producing future forest crops, and in controlling the growth factors which influence the properties of the wood.

SUPPLEMENTAL FUNDS

Projects	Obligated, 1939	Estimated obligations, 1940
<u>Emergency Relief, Agriculture, Forest Service (Transfer from WPA):</u> For projects in connection with research in forest products:		
1. Timber harvesting and conversion investigations	\$6,391	\$6,969
2. Forest products statistics
3. Pulp and paper investigations	9,436	10,290
4. Strength of wood investigations	9,971	10,873
5. Seasoning and physical properties investigations	8,519	9,290
6. Chemical composition investigations	5,002	5,454
7. Wood preservation investigations ...	8,391	9,150
8. Wood structure investigations	3,759	4,099
Total, supplemental funds	51,469	56,125
Administrative funds included above	1,760	854
Net, project funds	49,709	55,271

(j) FOREST SURVEY

Appropriation Act, 1940..... \$250,000
 Budget Estimate, 1941..... 250,000

PROJECT STATEMENT

Projects	1939	1940 (Estimated)	1941 (Estimated)
1. Forest survey.....	\$249,806	\$250,000	\$250,000
Unobligated balance.....	194	---	---
Total appropriation.....	250,000	250,000	250,000

WORK UNDER THIS APPROPRIATION

The Forest Survey is specifically authorized by Section 9 of the Act of May 22, 1928 (McSweeney-McNary Forest Research Act), which provides that the Secretary of Agriculture shall cooperate with appropriate officials of each State, either through them or directly with private and other agencies, in making a comprehensive survey of the present and prospective requirements for timber and other forest products in the United States and of timber supplies, including a determination of the present and potential productivity of forest land therein and of such other facts as may be necessary in the determination of ways and means to balance the timber budget of the United States.

The work includes an authoritative nationwide inventory of the extent, location, and condition of forest lands; the quantity, kinds, quality, and availability of timber now standing on these lands; the rate of depletion through cutting, fire, insects, disease, and other causes; the current and probable future rate of timber growth and the productive capacity of our forest area; and the present and probable future requirements for forest products in the different parts of the country by all classes of consumers, including many major industries. It also includes analyses of the relation of these findings to one another and to other economic factors as a basis in formulating policies, principles, and plans of forest-land utilization. It involves both field surveys and the compilation of existing data from a great variety of sources.

The Survey is currently obtaining forest resource information long desired and now vitally important as a guide in directing the course of national measures involving conservation and land use, such as balance of growth and depletion to build up growing stock and bring into effect sustained yield; correlation and distribution of industrial requirements with forest productive capacity of the soil; public acquisition of land for forest purposes; reversion of submarginal agricultural land to forests; Civilian Conservation Corps programs; Tennessee Valley development; employment opportunities; and creation of permanent forest communities. The accumulation and interpretation of data are far behind the current demand for information.

The Survey is conducted under the work project "Forest Survey" and mainly in the regions served by the following forest experiment stations:

(a) Appalachian.--It is especially important to push work here because of closeness to consuming centers, imminent pulp expansion and corresponding timber requirement, farm woodlot situation, and dearth of economic information on forest resource situation. This region of 75 million acres includes extensive areas of pine now being threatened by excessive pulp-mill expansion and important stands of highly prized hardwoods being cut without proper provision for regeneration. It is an important timber-producing area, close to consuming centers, going through industrial and rural change and expansion, characterized by a high percentage of community dependence on timber and important watershed value -- all these indicate the necessity of a realistic economic and forest program. Basic data for such a program result from the Survey. Field work is under way on a modest scale; the information is urgently needed.

(b) California.--Limited Federal funds have restricted work to the preparation of a forest cover type map to fill general needs and be of special use in the remaining steps of the work. The other phases of the Survey will follow as rapidly as funds become available.

(c) Lake States.--With the completion of the primary field work for the 60 million acres of forest land the continuing work of keeping the information up to date requires attention. In addition, in close cooperation with the three states, steady progress toward compilation, interpretation, and release of the information developed is being made. During the year lithographed forest type maps for parts of Minnesota and Michigan will be issued.

(d) Northern Rocky Mountain.--Because of the regional and national importance of the 28 million acres of forests in this territory, especially the highly prized white pine, the Federal government is spending large sums of money for fire and tree disease protection. In the public interest also there is an incessant demand for forest resource data upon which to base land-use plans for the four northwestern States. Field and office work is organized on a modest scale.

(e) Pacific Northwest.--Maintenance of the original survey in an up-to-date status is taking an increasing amount of time. A resurvey of five counties in critical areas covered nearly a decade ago was made. In addition effort was directed to the completion of comprehensive reports for the Douglas fir and pine regions and to preparation of state reports in close cooperation with the state forest agencies of Oregon and Washington. These reports should be completed during the year. Since the Survey information grows in basic importance as programs for a planned forest economy for this region develop, so do the demands for the information and for the services and advice of the Survey personnel.

(f) South.--Stretching over 8 states, including the naval stores district, the upland pine and hardwood areas and the Mississippi Delta hardwoods and the cotton belt with a declining acreage, this region looks to timber as one means of solving many of its economic and social problems. Except for parts of Texas and Oklahoma the Forest Survey field work is done. Fifteen Survey unit reports covering some 60 million acres were prepared and released. During the coming year it is planned to complete the unit reports for the entire area, five state reports, and get a good start on regional report for the South. In addition pioneering work was done to develop methods to maintain the Survey information in an up-to-date status. This will necessarily be continued and expanded in close cooperation with the Census and the States. Heavy demand for information, services, and consultation continues.

SUPPLEMENTAL FUNDS

Projects	Obligated, 1939	Estimated obligations, 1940
<u>Emergency Relief, Agriculture, Forest Service (Transfer from WPA):</u> For projects in connection with research in forest survey:		
1. Forest survey: present and future requirements.....	\$16,388	\$17,870
Administrative funds included above....	561	272
Net, project funds.....	15,827	17,598

(k) FOREST ECONOMICS

Appropriation Act, 1940	\$149,295
Budget Estimate, 1941	<u>140,900</u>
Decrease	<u>8,395</u>

PROJECT STATEMENT

Projects	1939	1940 :(estimated):	1941 :(estimated):	Increase or decrease
1. New public domain :	\$24,690:	\$24,350:	\$24,350:	- - -
2. Private forestry...:	67,900:	95,945:	86,650:	- \$9,295(1)
3. Stumpage, log, and: lumber prices....:	13,676:	14,000:	14,000:	- - -
4. Range economics...:	14,897:	15,000:	15,000:	- - -
5. Additional for ad- ministrative pro- motions	- - -	- - -	900:	+ 900(2)
Unobligated balance.....:	132:	- - -	- - -	- - -
Total appropria- tion	121,295:	149,295:	140,900:	- 8,395

INCREASE AND DECREASE

The net reduction of \$8,395 in this item for research in forest economics consists of:

(1) Decrease of \$9,295 for private forestry investigations.

This decrease will be met largely by reduction of force of employees on the permanent roll, and by reduction of the amount to be expended for temporary services.

(2) \$900 additional estimated for administrative promotions in accordance with the plan which is being uniformly applied in the Budget Estimates for 1941.

WORK UNDER THIS APPROPRIATION

General.—This is a series of studies which, in correlation with other forest research, strikes directly at efficient and economical ways of attaining the important forest land-use objectives upon which sound forest industrial plans must be based.

This work is specifically authorized by Section 10 of the Act of May 22, 1928 (McSweeney-McNary Forest Research Act), which provides for investigations of costs and returns and the possibility of profitable reforestation under different conditions in different forest regions: of the proper function of timber growing in diversified agriculture and in insuring the profitable use of marginal land, in mining, transportation, and in other industries; of the most effective distribution of forest products in the interest of both consumer and timber grower; and for other necessary economic investigations of forest lands and forest products. The work is conducted under the following projects:

1. New public domain investigations.—A "New Public Domain" is being created by the abandonment and reversion to public ownership through tax delinquency of cut-over forest land. This study is investigating the extent and trends of reversion in different regions, the feasibility of using the land for forest purposes, the desirable balance of ownership between Federal, State, and other public agencies, and the methods and aims of public administration and use. These investigations are conducted in the following regions:

(a) California. —This State has exceptionally acute and complicated problems of land use, especially in its 40 million acres of foothill area which constitutes a wide zone of conflicting use between the forested mountains and the agricultural valleys. Excessive overgrazing, long the rule, has seriously depleted the forage-producing capacity of the grazing lands. Former timber wealth is gone; the livestock industry is in serious straits. Agriculture is precarious; population and wealth are declining; communities are in distress; lands are tax delinquent and county governments are pinched. Land abuses in this marginal foothill zone combine with destruction of the forests at higher elevations to accelerate erosion and produce serious disturbances in the annual water crop, upon which all other crops in most of California depend. Through readjustments of land use many of these conditions can be ameliorated, and the high costs of local government services, such as roads and education, in sparsely populated areas, can be materially reduced. Fundamental information of first importance for corrective programs of land-use planning will be supplied as a result of this study, which should be continued by the Experiment Station.

(b) Lake States. —The abandonment of cut-over land has reached a more acute stage in the Lake States than in any other region. At least 20,000,000 acres of land have reverted to public ownership, or is suffering under long term delinquency. This study, prosecuted in cooperation with other Federal, State, and local agencies, is already supplying information and advice of vital importance to the formulation and application of constructive land utilization plans, including the correlation of agricultural and forest use,

the greatly expanded program of Federal acquisition, and the development of State and county forest systems, in the Lake States. The work should be continued.

(c) Pacific Northwest. --The destructive cutting on privately owned forest land in Oregon and Washington; the serious and increasing extent of tax delinquency, forfeiture, and abandonment of these lands; and the attempts to settle them for agricultural purposes have produced deplorable physical, economic, and social results. The instability of forest land ownership is increasing: precipitate losses are taking place in tax base and tax receipts essential for the maintenance of public services; and industries and the opportunity for labor are being lost. Added to these factors is the continued and uncontrolled practice of placing settlers on forest lands unsuited for agricultural purposes and remote from established roads, schools, and other advantages of community life, where fire is a hazard to life and property and where their presence adds to the burden of property owners, taxing jurisdictions, and social agencies.

But no legal control over these practices and no reasonably lasting solution of these problems are possible unless and until local awareness takes place, a delineation between forest and other lands is made, and ways of stabilizing ownership, employment, and social betterment are developed.

This study is supplying information necessary for the solution of this problem, and should be continued.

(d) South. --The acreage of forest land forfeited to public ownership through non-payment of taxes has increased to such an extent during recent years as to constitute a major problem in the fiscal affairs of the several States and their minor divisions, and an even greater problem in forest land-use planning.

The analysis of the causes, and the determination of the extent of this situation is one of the basic requirements in the development of a sound forest land-use policy. Data already available from this study are in demand by Federal and State agencies. Local governments are cooperating. Continued work is necessary.

2. Private forestry investigations.--Current work includes a search for ways and means of replacing the customary destructive methods of exploitation with the practice of forestry including sustained yield management on privately-owned lands.

This requires appraisal of the economic factors in various forest regions that are obstructing forestry practice, and the formulation of new operating methods, and of other means, including needed public assistance, that will aid in overcoming those obstacles. The work also includes studies of the financial aspects of forestry, especially of the costs and returns from timber growing, to determine for various forest regions where and under what conditions forestry may be successfully practiced; and of the potential contributions of forestry to community stability and prosperity.

These investigations are being conducted mainly in the following regions:

(a) Pacific Northwest. --The Douglas fir belt includes one-third of our remaining saw timber. Three-fifths is in private ownership and characterized by destructive utilization practices; cut-over land is often rendered completely unproductive by successive burning; sawmill capacity is far in excess of sustained yield capacity or market requirements. Altogether it represents the most serious and baffling "sore spot" in the nation's forest situation. This preliminary study has indicated that there are practical and profitable means, through changes in the mechanics of logging and in methods of cutting, of converting the industry to sustained yield management. Forest industries and local public and commercial agencies are insistent that this incomplete investigation be expanded as provided under increases.

In the Ponderosa pine belt, present operating practices are reducing potential rates of annual growth from as high as 200 to as low as 10 to 25 board feet per acre. This study will provide basic information needed in fixing diameter cutting limits, spacing of railroad spurs, skidding distances, and desirable types of machinery. In brief, information necessary for the elimination of wasteful and unsound practices, and for the stabilization of lumbering operations, communities, and labor conditions. The information to be obtained is in urgent demand.

(b) South. --Most of the 121 million acres of forest land is privately owned. Because of its enormous potential productive capacity and favorable location, the region is the logical source of timber for much of the eastern United States, and for export trade. The forest resource is the basis of the world's largest naval stores industry. But forest productivity has seriously deteriorated, and industry has correspondingly suffered, as the result of destructive practices. If the forest products industries are to be rehabilitated, and forest productivity restored and maintained, the practice of forestry must be in the general rule on private land. The development of private forestry is therefore of the utmost importance, not only from the standpoint of the region itself because of the extent to which local economy must be based upon the forest resource, but to the whole eastern United States.

An analysis of the cost of growing timber and the returns to be derived therefrom, in other words, the conditions under which private forestry will be practicable, is especially needed. This study is obtaining this information for the shortleaf-loblolly type, through work centering in southwestern Arkansas.

(c) Allegheny. --This work initiated in the fiscal year 1940 is to study the present and future potentialities of forest management in the Pennsylvania Anthracite coal region, particularly as a means of relieving a critical unemployment situation. This area includes about 3 million acres of cut-over forest land, the timber from which once contributed heavily to local industry, but the land is now largely unproductive. Rehabilitation of the forest resource might be handled so as to provide increased employment in the region and permanent benefits. Sound forest development programs which provide employment must be based on accurate information on the kind of work to be done, and the quantitative and qualitative labor requirements for each phase.

(d) Northeast. --The work here is to obtain the technical basis for, and to determine optimum methods of organization for cooperative timber production, manufacturing, and marketing enterprises, particularly for farmers and other small owners. Unrestricted cutting of timber on farm woodlands, largely prompted by heavy demand from adjacent industrial population, has depleted the available timber to a point where many industries have been forced to move to other regions. Returns to woodland owners from the sale of timber are relatively low and realized only once in several decades. Manufacturing and marketing of forest products is generally on a haphazard and uncertain basis. Specifically, the procedure is to study the possibilities of cooperative management of small timber holdings, particularly farm woodlands, in typical natural units with the belief that proper forest management methods will permit a regular and dependable source of income to farmers and others. Studies in methods of cooperative cutting, transportation, manufacturing, and marketing are also included.

(e) Central. --This study has the same general objectives as the Northeast investigations described in the preceding paragraph. A steady demand for timber in the agricultural sections of the Central States provides very favorable opportunities for profitable forestry.

(f) Lake States. --The farm woodlands of the Lake States are potentially a very important feature of farm economy. They furnished forest material valued at \$37,000,000 in 1929. With the depletion of virgin timber supplies, wood-using industries are turning more and more to farm woodlands for raw materials, but heavy overcutting is resulting in a steady process of deterioration which is constantly reducing yields and, if continued, will also reduce income. The purpose of this study is to develop simple methods of economic organization that will give farmers the benefit of collective action in forest management and in such utilization and disposal of forest products as will improve the quality and quantity of farm woodland production, insure a steady field for labor and income for the landowner, and increase the effectiveness of farm woodlands as soil protection cover.

3. Stumpage, log, and lumber price investigations.--Stumpage and log prices are important elements in the cost of lumber and other wood products. They are not compiled on a nation-wide basis by any other agency. They are necessary in other important forest economic studies and influence the formulation and development of national State, and private forest programs, and are of value to the industry.

Current work includes the compiling and analyzing of price data for previous years from all available sources; the development of price trends and indexes; the comparison with price trends and indexes of important agricultural crops; the compilation of current price data; and the publication of an annual statistical bulletin. Basic data are collected annually through a cooperative agreement with the Bureau of the Census. Work to date has been confined mainly to stumpage and log prices. Work on lumber prices is as yet fragmentary because of limited facilities and funds. This is an important and continuing project. The work is done mostly in Washington.

4. Range economics investigations.--Intermountain. The importance of the range resources of this region and the necessity for their rehabilitation and wise use are being recognized more and more. The purpose of this study

is to determine, for various conditions and combinations of livestock raising and agriculture, what size range unit is best adapted for family economy and how Federal range lands can best be integrated with such units. It is of vital importance in this region that the privilege of range use, particularly of the national-forest ranges, be neither unduly concentrated nor unduly dispersed. It must be distributed in a way that will promote prosperous family units and well-balanced permanent communities. The study will necessarily review the factors underlying the use of range lands in each type of community. It will involve, among other things, an analysis of the dependence of typical communities on range resources. The results of the study should afford a basis for equitable redistribution if found to be needed. This investigation will supplement, on the economic side, the program of range research provided for under Section 7 of the McNary-McSweeney Forest Research Act.

SUPPLEMENTAL FUNDS

Projects	Obligated, 1939	Estimated obligations, 1940
<u>Emergency Relief, Agriculture,</u> <u>Forest Service (Transfer from WPA):</u> For projects in connection with research in forest economics:		
1. New public domain investigations....	\$ 98	\$ 107
2. Private forestry investigations.....	14,360	15,659
3. Stumpage, log, and lumber price investigations.....
4. Range economics investigations.....	160	174
Total, supplemental funds.....	14,618	15,940
Administrative funds included above....	500	243
Net, project funds.....	14,118	15,697

(1) FOREST INFLUENCES INVESTIGATIONS

Appropriation Act, 1940	\$ 139,152
Budget Estimate, 1941	<u>135,400</u>
Decrease	<u>- 3,752</u>

PROJECT STATEMENT

Projects	1939	1940 (Estimated)	1941 (Estimated)	Increases or decreases
1. Influence of forests on streamflow.....	\$66,378	\$66,495	\$63,822	-\$2,673(1)
2. Utilization of water by trees.....	41,232	41,305	41,305	---
3. Stabilizing soils.....	16,843	16,873	16,873	---
4. Effect of forest cover on climate.....	14,453	14,479	13,000	-1,479(2)
5. Additional for administrative promotions.....	---	---	400	+400(3)
Unobligated balance.....	246	---	---	---
Total appropriation.....	139,152	139,152	135,400	-3,752

INCREASES AND DECREASES

The net reduction of \$3,752 in this item consists of:

(1) A decrease of \$2,673 for investigations on the influence of forests on streamflow.

(2) A decrease of \$1,479 for investigations on the effect of forest cover on climate.

These two decreases will be met largely by reduction of force.

(3) \$400 additional estimated for administrative promotions in accordance with the plan which is being uniformly applied in the Budget Estimates for 1941.

WORK UNDER THIS APPROPRIATION

General.---The research under this program is directed to a determination of the effect of forest, brush, or range cover, or of combinations of them as found on national forests and other forest lands, on soil and water. Its purpose is to determine how and to what extent forest cover may serve as the major factor in providing satisfactory conditions of water flow and soil stability on entire watersheds or important parts of watersheds; and the conditions of use, including extent of cutting and grazing, which will afford the best results. It seeks to ascertain how to deliver the maximum amounts of usable water for navigation, irrigation, municipal use, power, etc.; to make waste lands productive; to protect against destructive floods; and to safeguard public and private works -- investments which already aggregate hundreds of millions of dollars. It is designed to furnish facts and remedial measures as a basis for action by Federal, State, and other agencies.

Practically every watershed in the United States contains some portion of the 615 million acres of forest land or of the 585 million acres of non-forest range land, or both. The recurrent record-breaking floods of recent years, the increasing demand for irrigation water throughout the West, the increasing interest in the water resources for recreation, the recognition of the possibilities of controlling siltation of streams and reservoirs, the shortage of municipal water for many cities and towns not only during drought years but almost annually, and the recurrent threat to health of inadequately diluted pollution, greatly accentuate the problems caused by increasing population and demand for water and focus attention on the value and place of the forest and range cover and its relation to streamflow regulation and the whole water cycle. This is a continuance of the item carried in the Agricultural Appropriation Act under various headings since 1931, for investigations and experiments for determining and demonstrating the influence of vegetative cover characteristic of national forest and range, or other wild land, on water yield, flood control, streamflow regulation, climate, and soil stability, and for developing measures to increase the effectiveness of the forest cover as an agent for controlling water behavior and soil. The work is carried on under the following projects:

1. Influence of forests on streamflow.---This activity deals with the effects of natural cover, as on National Forests, on water supply. It includes studies of the effects of forests and related natural plant cover types on high and low-water flows, on the regularity of water flow, and in short, on the effect of natural cover on the usable water yield. It is to determine how best to manage the forest that favorable conditions of water flow may be maintained. It is to supply the basic data needed in planning water developments in forest areas and in planning flood control projects. It supplies some of the basic framework for policies and programs on the national forests, and on other public and private forest and wild lands. A number of the earlier established national forests were created from the

public domain primarily to protect local water supplies. Recent additions to others, and the purchase program under the Weeks Law is to aid in the rehabilitation and protection of watersheds of important rivers. Rapid rehabilitation of acquired areas and the proper management and protection of the forest and range cover on many national forest lands is essential to the continued prosperity, welfare or safety of thousands of people dependent upon them for domestic and irrigation water supplies, for flood control, and for sustained and regular streamflow.

Finally, this project determines what changes, both good and bad, in the water and soil resources of the national forests and similar lands result from measures and treatments applied to tree, brush, and forage cover. It furnishes a basis, therefore, for the sound development of broad programs, management policies, and work plans. Work is now under way at the California, Intermountain, Rocky Mountain, Appalachian, Southern and Lake States Forest Experiment Stations.

2. Utilization of water by trees.—Studies of the utilization of water by trees and associated vegetation reveal the amount of water consumed and so prevented from reaching the streams and profitable use. Such depletion of soil-water supplies may not be serious in the humid regions but in the arid sections, this depletion may have a profound effect on available water supplies. A knowledge of the consumptive use of water by forest and range vegetation, of the conditions under which this use is most pronounced, of the types of trees that make most demands on the soil-water and how the use can be controlled is essential in the proper management of forests where usable water may be even more valuable than the timber. The results of these investigations to date are showing that certain species are much more economical of water than others and where water is precious should be favored in silvicultural work and in reforestation. Work is under way in the California, Intermountain, Southwestern, Rocky Mountain and Appalachian Forest Experiment Stations.

3. Soil stabilization.—Under soil stabilization are carried investigations of the rate and magnitude of soil movement to and in streams with watersheds protected by forest, brush, and range vegetation; of the results, in terms of soil stability, of various degrees and kinds of treatments and use of timber and forage; and of methods of holding avalanches, rock slides, and landslips in place; to develop measures for preventing streambed scouring in mountain torrents; and to develop special measures for holding soil in place in critical areas where the forest and range cover has been destroyed by fire, cutting, or overgrazing. The investigations are directed toward understanding of the processes of soil formation and movement under forest and other natural cover, for the purpose of preventing heavy losses, caused by debris movement, to property, irrigation, and flood control works, and water supplies, and of increasing the usability of streamflow from forest and other wild lands.

The results of such studies have been of inestimable value in developing the program for flood control in such areas as southern California and northern Utah where the debris from depleted watersheds and uncontrolled torrents was of such great volume as practically to ruin many large engineering control works. Results from these investigations are being put into

practice currently on areas recently added to the national forests and on many other forest areas by such agencies as the CCC, WPA, etc. Work is under way in the California, Intermountain, Southwestern, and Appalachian Forest Experiment Stations.

4. Effect of forest cover on climate.—Studies of the effect of forest on climate are to determine the value of windbreaks and shelterbelts in reducing wind velocity, in reducing transpiration of crops and the evaporation from soil and snow, in getting better distribution of the snow cover, and in safeguarding crops from excessive temperatures. They are also to determine the effect of forests and other cover on the distribution, accumulation and melting of snow, on the depth of frost in the soil, on evaporation, and on other climatic factors.

Such investigations have an important bearing on widespread forestry activities. In the Plains Region, they determine the effect that shelterbelts of different height, width, density, and species have on the local climate. They determine the manner in which trees in a shelterbelt shall be planted, pruned, or thinned, the distance apart between shelterbelts, and their orientation with respect to the direction of the disastrous hot summer winds. In this way, they lay the foundation for maximum benefits from shelterbelt and windbreak planting at minimum cost.

In sections where frozen ground may be a factor in floods, they determine for forests of different species and densities the depth to which the soil freezes, the distribution of the snow cover in the forest and its rate of melting in the spring; the interception and evaporation of rain and snow by the forest canopy. Such information is needed in planning upstream flood control work, in determining the amount of water available for irrigation from snow melt, and in evaluating the water loss of precipitation through evaporation. Results of such studies are being put into effect in thinning practices on the national forests, in planting programs, and in methods of cutting in regions where such cutting may have a bearing on the water problem.

Work under this project is under way at the Appalachian, Lake States, and Rocky Mountain Forest Experiment Stations.

SUPPLEMENTAL FUNDS

Projects	Obligated, 1939	Estimated obligations, 1940
<u>Emergency Relief, Agriculture, Forest Service (Transfer from WPA):</u> For projects in connection with re- search in forest influences:		
1. Influence of forests on streamflow.....	\$71,252	\$77,697
2. Utilization of water by trees.....	35,242	38,430
3. Stabilizing soils.....	9,513	10,373
4. Effect of forest cover on climate.....	5,762	6,283
Total, supplemental funds.....	121,769	132,783
Administrative funds included above.....	4,165	2,021
Net, project funds.....	117,604	130,762

(m) TROPICAL FOREST EXPERIMENT STATION

This appropriation for which a separate appropriation of \$30,000 was provided by the Agricultural Appropriation Act for the fiscal year 1940, has been merged with the appropriation "Forest Management" in the 1941 estimates.

(n) FOREST-FIRE COOPERATION

Appropriation Act, 1940	\$2,200,000
Budget Estimate, 1941.....	<u>2,200,540</u>
Increase.....	<u><u>540</u></u>

PROJECT STATEMENT

Projects	1939	1940 (Estimated)	1941 (Estimated)	Increase
1. Forest taxation and insurance investigations.....	\$41,127	\$45,000	\$45,000	—
2. Cooperation with States in forest-fire prevention and suppression.....	1,956,266	2,155,000	2,155,000	—
3. Additional for administrative promotions...			540	+\$540(1)
Unobligated balance.....	2,607	—	—	—
Total appropriation..	2,000,000	2,200,000	2,200,540	+540

INCREASE

(1) The increase of \$540 in this item for 1941 is the additional amount/for administrative promotions in accordance with the plan which is being uniformly applied in the Budget Estimates for 1941.

WORK UNDER THIS APPROPRIATION

1. Forest taxation and insurance.—This project involves local application studies, in cooperation with State and other agencies, necessary to supplement, adapt, and effect the general conclusions and principles already determined to the widely varying conditions of individual States. Taxation under present methods is generally recognized as one of the greatest obstacles to private forestry practice and a major cause of forest destruction. Interest in forest taxation is widespread on the part of forest owners, State and local authorities, and the agencies concerned with the conservation and development of forest resources. Urgent demand is being made for aggressive Federal assistance in obtaining forest-taxation reform to accomplish the stated objectives of forest conservation and the rehabilitation of the forest-products industries under the economic programs of the Administration.

This demand has been stimulated by the critical tax situation in many forest regions and by the growing opinion that reform in taxation is vitally needed if the standards of private forestry practice are to be substantially improved. This project also includes further studies and promotional effort looking toward the establishment of a system of forest-fire insurance based on principles already established by past research. There is pressing need and demand for such a system in order to permit economical sharing of fire risk in private forestry practice.

2. Cooperation with States in Forest Fire Prevention and Suppression.—Forty-one States and the Territory of Hawaii cooperate with the Federal Government in forest fire protection under Section 2 of the Clarke-McNary Law. The number of cooperating States gradually increases — Colorado is participating in the program for the first time during Fiscal Year 1940. The cooperating with the States is based on agreements which provide for plans of work and annual budgets by the individual States, Federal reimbursement being made after the work has been done and payment therefor made by the State. The Forest Service provides technical assistance to aid in improving standards of work, and to assure compliance with agreements. Active cooperation and leadership is provided in the development and adaptation of new and improved fire-fighting and fire-control equipment and methods. Federal leadership is given in the adaptation of radio for fire-control work, a phase of the protective work which is assuming essential proportions.

State and private agencies expect the Federal Government to take leadership and furnish assistance in forest fire control. Of the 76,326 fires which occurred on state and private forest lands which were under protection during 1938 at least 64,312 (approximately 85%) were definitely established as having been man-caused, either by smokers, campers, lumbering, etc. This places the problem of protection as clearly one of public responsibility.

The backbone of forest fire protection in the United States is the Clarke-McNary cooperative program. It coordinates the efforts of Federal, State and private agencies, without it the problems of protection would be chaotic.

The following table shows, by States, the Federal allotments compared with contributions by State and private agencies for forest-fire cooperative work under the provisions of Section 2 of the Clarke-McNary Act.

STATE ALLOTMENT DATA
FOREST FIRE COOPERATION UNDER SECTION 2 OF THE CLARKE-McNARY LAW

STATE	State and private : funds budgeted, fiscal year 1940 :	Federal allotments, fiscal year 1940 (a)
Maine.....	\$158,577	\$47,171
New Hampshire.....	139,264	16,232
Vermont.....	27,403	6,830
Massachusetts.....	216,711	32,207
Rhode Island.....	17,862	2,472
Connecticut.....	81,123	15,692
New York.....	423,638	70,107
New Jersey.....	140,165	37,325
Pennsylvania.....	278,611	50,739
Delaware.....	9,774	2,159
Maryland.....	61,711	13,702
Virginia.....	89,041	41,704
West Virginia.....	165,580	35,493
Kentucky.....	20,440	20,440
North Carolina.....	133,072	69,196
South Carolina.....	156,645	51,178
Georgia.....	153,167	80,397
Florida.....	296,727	102,736
Alabama.....	142,300	57,552
Mississippi.....	75,691	53,765
Louisiana.....	164,000	52,172
Texas.....	108,042	50,770
Oklahoma.....	19,483	18,340
Arkansas.....	117,655	63,415
Tennessee.....	76,759	32,134
Michigan.....	516,672	130,815
Wisconsin.....	442,216	91,784
Minnesota.....	312,232	96,626
Ohio.....	29,150	8,133
Indiana.....	61,322	10,095
Illinois.....	23,048	5,575
Missouri.....	15,500	15,500
Montana.....	90,374	26,079
Idaho (N).....	150,124	50,850
Idaho (S).....	30,045	8,222
South Dakota.....	2,992	1,245
Colorado.....	3,750	2,150
New Mexico.....	8,419	2,965
California.....	1,029,744	204,460
Nevada.....	7,493	2,405
Hawaii.....	6,030	1,365
Washington.....	662,703	145,722
Oregon.....	794,967	161,021
Total allotments to States...	7,460,222	1,988,940
Administration and contingent expenses.....		166,060
Forest Taxation and Insurance Project.....		45,000
Total appropriation.....		\$2,200,000

(a) Estimated allotments for 1941 are the same as for the fiscal year 1940, although actual allotments for 1941 will depend upon State expenditures.

(c) NEW ENGLAND HURRICANE DAMAGE

Appropriation, 1940.....
 First Deficiency Act 1939 (available balance
 for 1940 from 1939 appropriation of \$5,000,000
 for hazard reduction and fire prevention in
 New England States) (a)..... \$4,528,802(1)
 Budget Estimate, 1941..... 300,000
 Decrease..... 4,228,802

PROJECT STATEMENT

Project	1939	1940 (Estimated)	1941 (Estimated)	Decrease
New England emergency project.....	\$471,198	\$4,528,802 ^(a)	\$300,000	-\$4,228,802(1)

(a) Total appropriation \$5,000,000, of which \$471,198 expended in fiscal year 1939.

(1) The decrease of \$4,228,802 in this item represents the difference between the amount available for expenditure in the fiscal year 1940 from the appropriation in the 1939 Deficiency Act and the amount of the Budget estimate for the fiscal year 1941 for the hazard reduction and fire-prevention work in the New England States. The Budget estimate contemplates that beginning July 1, 1940 this work will be handled through the State Forestry departments of the States involved.

WORK UNDER THIS APPROPRIATION

The New England hurricane of September 21, 1938, destroyed over 3 billion board feet of timber and spread havoc over an area of approximately 14 million acres. More than 600,000 acres were a tangled mass of timber and wreckage. This area was not a solid block but was scattered throughout New England so that almost the entire central part of this region was affected. Also scattered throughout this area are communities, homes, and people. Hundreds of homes were completely surrounded by wind-thrown pine and as the needles became dry, the forest fire hazard and the danger to human life and property became extreme. It is essential, for the safeguarding of human life and property, to reduce the forest fire hazard as quickly as possible and to maintain a fire patrol and suppression organization in the more hazardous areas.

Besides the work of actual fire hazard reduction, the very presence of Federal crews in the field averted a major catastrophe in 1939 so far as forest fires were concerned. During the 1939 spring fire season the

Federal crews were called repeatedly to fires by the State Forestry organizations. The Sharon (New Hampshire) fire was a typical example. If Federal crews had not been promptly available it is likely this forest fire would have completely destroyed the town of Sharon.

Three classes of essential and interrelated work have been carried on as follows: (1) removal and disposal of highly inflammable needles and branches from trees blown over by the hurricane, (2) the placing of fire patrols for prevention and detection of forest fires; and (3) the actual suppression of fires by properly equipped fire suppression crews. Crews working in the first group on disposal work and trained and equipped for emergency duty in actual fire suppression and a closely coordinated work program is designed to permit the maximum amount of effective disposal work with the immediate availability of the necessary trained man power for fire suppression.

(p) COOPERATIVE DISTRIBUTION OF FOREST PLANTING STOCK

Appropriation Act, 1940	\$100,000
Budget Estimate, 1941.....	<u>100,000</u>

PROJECT STATEMENT

Project	1939	1940 (Estimated)	1941 (Estimated)
Payment to States for cooperative distribution of forest planting stock.....	\$99,826	\$100,000	\$100,000
Unobligated balance.....	174
Total appropriation....	100,000	100,000	100,000

WORK UNDER THIS APPROPRIATION

The work under this appropriation consists of active cooperation with forty-two states and two territories in the procurement, production, and distribution of forest tree seeds and plants to farmers for the establishment of windbreaks, shelter strips and woodlands upon nonforested and submarginal farm lands. The work is directly administered by the cooperating state agencies, with technical assistance and advice, inspection, and correlation by the Forest Service. Planting stock must always be grown in advance of needs and the participation by the Federal Government in this cooperative program makes it possible for the individual states to maintain the essential nursery facilities and lay plans sufficiently far in advance to permit efficient and economical operation. This tree distribution program provides a medium whereby the farmer can secure at nominal cost the forest trees necessary to put submarginal farm lands to gainful use and to establish a farm timbercrop.

The Federal cooperation under this appropriation is provided to the state agencies by means of reimbursement after the work has been performed and paid for by the state. In excess of 55 million trees were distributed to farmers during the calendar year 1938 under the cooperation, an increase of 13 million trees over the preceding year, and the largest number ever distributed in one year since the initiation of the cooperative work.

No ornamental or shade trees are distributed under this program, nor do any of the trees grown enter commercial channels. Only stock suitable for field planting is produced, procured, or distributed. The facilities of the project are available to the states for participation in tree planting programs in connection with CCC work, soil and water conservation work, flood control work, and other tree planting activities under work relief and conservation programs. Farmers are rapidly realizing the economic value of farm woodlands as supplemental sources of cash income, as well as a means of providing material for use on the farm. In many regions farm windbreaks are important as a means of climatic protection, livestock protection, and drought amelioration, and there is much demand for trees for windbreak planting. Many of the states are unable to supply the demand for trees under this cooperative tree distribution program.

(q) ACQUISITION OF LANDS FOR NATIONAL FORESTS

Appropriation Act, 1940	\$3,000,000
Budget Estimate, 1941	<u>1,000,900</u>
Decrease	<u>\$1,999,100</u>

PROJECT STATEMENT

Projects	1939	1940 (Estimated)	1941 (Estimated)	Increase or decrease
Acquisition of land for National Forests	\$2,682,613	\$2,875,000	\$935,000	-\$1,940,000(1)
Additional for administra- tive promotions	---	---	900	+900(2)
Transferred to:				
Office of the Solisi- tor	116,605	120,000	60,000	-60,000(1)
Department of Justice	96,000	---	---	---
Bureau of Agricultur- al Economics	---	5,000	5,000	---
Unobligated balance	104,782	---	---	---
Total appropriation	3,000,000	3,000,000	1,000,900	-1,999,100

INCREASE OR DECREASE

The decrease of \$1,999,100 in this item for 1941 consists of:

- (1) A reduction of \$2,000,000 in the land acquisition program.
- (2) \$900 additional estimated for administrative promotions in accordance with the plan which is being uniformly applied in the Budget Estimates for 1941.

WORK UNDER THIS APPROPRIATION

The accomplishment of the major objectives outlined in this project are predicated upon the vesting in Federal ownership of privately-owned land within the 85 national forest purchase units established under the aforementioned Act of March 1, 1911, as amended, and in additional units which may be established under that act. The establishment of areas as purchase units is preceded by national and state surveys of forest areas and conditions, the specific determination and definition of areas for which Federal ownership is dictated, and the determination of land ownerships within such areas. Following the establishment of areas and definition of boundaries, the accomplishment of land acquisition entails the solicitation of offers of sale to the United States; detailed examination, estimates, cruises, and appraisals of the offered lands to determine their

value, negotiations with the owners thereof to obtain options; preparation of detailed reports or review by executive officers and the National Forest Reservation Commission, survey of lands in the regions not covered by public survey; prosecution of the work necessary to perfect satisfactory titles and final vesting of the land in Federal ownership by payment of the purchase price. The major portion of the cost of acquiring lands under this project is borne by the special appropriations or allotments made available for that purpose, but certain of the costs of administrative review and action, particularly in selecting areas to be established as purchase units, are properly chargeable against the general expenses of the Forest Service.

(r) ACQUISITION OF LAND FROM NATIONAL FOREST RECEIPTS (RECEIPT LIMITATION)

Appropriation Act, 1940 \$71,000
 Budget Estimate, 1941 71,000

PROJECT STATEMENT

Projects	1939	1940 (Estimated)	1941 (Estimated)
Acquisition of lands in:			
(1) Uinta and Wasatch National Forest (Utah)	\$49,624	\$40,000	\$40,000
(2) Cache National Forest (Utah only)	--	6,000	6,000
(3) San Bernardino-Cleveland National Forest (Riverside County, California only)	--	15,000	15,000
(4) Nevada-Toiyabe National Forest (Nevada)	--	10,000	10,000
Unobligated balance	376	--	--
Total Appropriation	50,000	71,000	71,000

WORK UNDER THIS APPROPRIATION

1. Uinta and Wasatch National Forests (Utah).--By the Act approved August 26, 1935 (49 Stat. 866), Congress authorized the Secretary of Agriculture to acquire lands within the Uinta and Wasatch Forests, Utah; and the appropriation for that purpose of the entire receipts for said forests, not exceeding \$50,000 per annum. To avoid undue reduction in the shares of such receipts payable to the counties under the provisions of the Act approved May 23, 1908 (35 Stat. 260), it is recommended that the appropriation for land acquisition for the fiscal year 1941 be \$40,000; although the desirability of a continuous and undiminished program of purchase generally is recognized by all agencies concerned, including county and municipal officials.

The areas in which purchases have been and are to be made are parts of watersheds upon which numerous communities and irrigation projects are vitally dependent. Certain parts of such watersheds are subject to exceptionally severe flood damage and soil erosion; when and where the protective forest and brush cover has been removed restoration of such cover is therefore a matter of most urgent necessity. Purchases hitherto made under the provisions of the Act of August 26, 1935, have been in the Uinta National Forests 19,846 acres at a total cost of \$73,618 or an average of \$3.71 per acre; in the Wasatch National Forest 36,279 acres at a total cost of \$91,389 or an average of \$2.52 per acre. The lands remaining to be purchased

will cost about the average prices hitherto paid. The acreage remaining to be acquired is not readily determinable, since it depends on the care with which the owners of the private lands use and manage their properties. In the light of present information, the expectation is that to meet all requirements of public interest it will be necessary to purchase about 11,000 acres additional in the Uinta National Forest and about 30,000 acres in the Wasatch National Forest.

2. Cache National Forest (Utah only).--By the Act approved May 13, 1938 (Public No. 505, 75th Congress, 2nd Session), Congress authorized the Secretary of Agriculture to acquire lands within that part of the Cache National Forest situated in Utah, and the appropriation for that purpose of the part of the annual receipts from said forest proportionately equal to the part of the forest situated in the State of Utah. The average annual receipts for the past three years have been \$12,843.90; the part of the National Forest situated in Utah is 50 percent.

The lands to be acquired constitute parts of watersheds used intensively for irrigation and presenting unusual dangers of flood damage and soil erosion. A considerable number of communities and individuals are wholly dependent upon the watersheds involved for both domestic water supply and irrigation water. By extending to the lands the same types of protection and management now applied to the national-forest lands, a large measure of public benefit will result. Interested communities and counties plan to donate their holdings to the United States. The cost of the land to be acquired normally will range from \$1.00 to \$5.00 per acre. At the rate of appropriation authorized, a long period of time would be required to vest in federal ownership all the lands which should be so owned; but with the amount annually authorized, lands can be acquired in the most critical areas, especially where contiguous to lands already in public ownership or to be donated to the United States, so that definitely beneficial results can be accomplished through the proposed program of acquisition.

3. San Bernardino-Cleveland National Forests, Riverside County, California.--By Act approved June 15, 1938 (Public No. 634, 75th Congress, 2nd Session), Congress authorized the Secretary of Agriculture to acquire lands within that part of the San Bernardino and Cleveland National Forests situated in Riverside County, California; and the appropriation annually of the parts of the entire receipts of said national forests proportionate to their respective areas within Riverside County. Of the San Bernardino National Forest 30.5 percent, and of the Cleveland National Forest 15.5 percent are within Riverside County. For the fiscal year 1938 the entire receipts of the San Bernardino National Forest were \$43,740.74; of the Cleveland National Forest \$7,781.85. Assuming the same receipts for the fiscal year 1941, which seems probable, the maximum appropriation allowable under the Act of June 15, 1938, would be \$14,547.09.

The lands to be acquired are private holdings intermingled with the present national forest lands. Due to the dense populations and intensive development of irrigated agriculture, the watersheds of the two forests are of great importance and every practicable means must be employed to protect them from denudation by fire, overgrazing, logging or

tillage. Lands privately acquired prior to the establishment of the forests increase the difficulties of protection and maximum beneficial utilization of national forest lands; except where managed under acceptable principles, as by water companies. The acquisition of such lands therefore will be an eventual economy. If the authorized appropriations are made, the Department each year will select an equivalent value of the most critical areas and thus gradually establish the more complete federal control essential to the welfare and security of the dependent communities. Due to rather wide variations in the values of the lands, from \$1.00 to \$10.00 per acre, and uncertainty as to which lands most readily can be acquired, it is not practicable to state accurately the number of acres that will be purchased with the proposed appropriation.

4. Nevada-Toiyabe National Forests, Nevada.--By the Act approved June 25, 1938 (Public No. 478), Congress authorized the acquisition of lands in the Nevada and Toiyabe National Forests, Nevada, by the Secretary of Agriculture, and the appropriation for that purpose of the receipts from said national forests, not exceeding \$10,000 per year. Within the forests named and widely intermingled with national forest lands are approximately 28,500 acres which prior to the creation of the forests were appropriated under the public land laws, primarily to control the use of much larger tributary acres of public lands through ownership of sources of range water supply or rights-of-way. Private ownership of such lands makes it difficult to most effectively use and equitably allot the use of the forage and other natural resources and makes it possible for the lands to be used in ways destructive to their highest public values. Public ownership of the lands, therefore, would markedly facilitate the administration and management of the national forests, with possible economies in costs of administration. The lands can be acquired at prices ranging from \$2.00 to \$3.50 per acre, and their total aggregate cost should be less than \$100,000. If the full limit of the authorization were appropriated each year, the acquisition of the necessary lands would require about nine to ten years for completion.

(s) PAYMENTS TO STATES AND TERRITORIES, NATIONAL FORESTS FUND

Appropriation, 1940 (revised)	\$1,200,000
Budget Estimate, 1941	<u>1,200,000</u>

PROJECT STATEMENT

Project	1939	1940 (Estimated)	1941 (Estimated)
Payments to States and Territories from national forests fund.....	\$1,135,749	\$1,200,000	\$1,200,000

WORK UNDER THIS APPROPRIATION

The law requires that 25 percent of all money received from the national forests during any fiscal year be paid to the States and territories in which the forests are located. The amount of this appropriation varies each year in direct proportion to national forest receipts during the previous fiscal year.

(t) PAYMENTS TO SCHOOL FUNDS, ARIZONA AND NEW MEXICO, NATIONAL
FORESTS FUND

Appropriation Act, 1940	\$30,000
Budget Estimate, 1941	<u>30,000</u>

PROJECT STATEMENT

Projects	1939	1940 (Estimated)	1941 (Estimated)
Payments to school funds, Arizona and New Mexico, national forests fund....	\$31,466	\$30,000	\$30,000

WORK UNDER THIS APPROPRIATION

At the close of the year there is paid to the States of Arizona and New Mexico such proportion of the gross proceeds of all the national forests within these states as the area of land granted to the states for school purposes within the national forests bears to the total area of all national forests within the states. These payments are required by the Act of June 20, 1910 (36 Stat. 562 and 573) which provides "That the grants of Sections two, sixteen, thirty-two and thirty-six to said state, within national forests now existing or proclaimed, shall not vest the title to said section in said state but said granted sections shall be administered as a part of said forests, and at the close of each fiscal year there shall be paid to the Secretary of State, as income for its common-school fund, such proportion of the gross proceeds of all the national forests within said state as the area of lands hereby granted to said state for school purposes which are situated within said forest reserves may bear to the total area of all the national forests within said state the amount necessary for such payment being appropriated and made available annually from any money in the Treasury not otherwise appropriated."

(u) ROADS AND TRAILS FOR STATES, NATIONAL FORESTS FUND

Appropriation Act, 1940	\$510,000
Budget Estimate, 1941	480,000
Decrease	<u>30,000</u>

PROJECT STATEMENT

Projects	1939	1940 (Estimated)	1941 (Estimated)	Decrease
Roads and Trails for States, national forests fund.....	\$450,225	\$510,000	\$480,000	-\$30,000(1)
Unobligated balance.....	59,775
Total appropriation.	510,000	510,000	480,000	-30,000

DECREASE

(1) The decrease of \$30,000 in this item for the fiscal year 1941 has been made after a revision of the annual expenditures during the past five years.

. WORK UNDER THIS APPROPRIATION

An additional 10 per centum of all moneys received from the national forests during each fiscal year is available at the end thereof to be expended by the Secretary of Agriculture for the construction and maintenance of roads and trails within the national forests in the states from which such proceeds are derived. (16 U.S.C. 501).

(v) COOPERATIVE WORK, FOREST SERVICE
(Trust Account)

Appropriation Act, 1940 \$1,000,000
Budget Estimate, 1941 1,000,000

PROJECT STATEMENT

Projects	1939	1940 (Estimated)	1941 (Estimated)
1. Construction of improvements.....	\$141,071	\$145,000	\$145,000
2. Maintenance of improvements.....	129,078	130,000	130,000
3. Prevention and suppression of forest fires.....	283,698	292,000	292,000
4. Disposal of brush and other debris in timber-sale operations.....	153,435	170,000	170,000
5. Forest investigations.....	31,515	32,000	32,000
6. Administration.....	42,241	43,000	43,000
7. Reforestation.....	26,858	28,000	28,000
8. Refunds to cooperators.....	9,761	10,000	10,000
Total obligations.....	817,657	850,000	850,000
Transferred to Public Roads Administration.....	+145,696	+150,000	+150,000
Total appropriation.....	963,353	1,000,000	1,000,000

WORK UNDER THIS APPROPRIATION

Contributions made to the Forest Service by individuals, communities, and associations for improvement work, fire control, forest investigations, slash disposal of timber sale areas, and administration of privately owned land within national forest boundaries are deposited to this fund, for expenditure by the Forest Service.

EMERGENCY FUNDS

Prairie States Forestry Project

Projects	Obligated 1939	Estimated obligations 1940
<u>Emergency Relief, Agriculture, Forest Service (Transfer from W.P.A.)</u>		
For expenses of the Prairie States Forestry Projects, (North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, and Texas)		
Administrative expenses.....	\$98,228	\$98,000
Project funds.....	2,343,203	2,115,000
Totals.....	2,441,431	2,213,000

SUPPLEMENTAL FUNDS

Projects	Obligated 1939	Estimated obligations 1940	Estimated obligations 1941
1. <u>Special Research Fund, Department of Agriculture</u> : For special research on forestry and forest products.....	\$5,799	\$3,600	\$3,600
2. <u>Conservation and Use of Agricultural Land Resources</u> : For examination of privately-owned range land in connec- tion with range conservation program and for field administration of naval- stores conservation program.....	46,528	47,421	47,421
3. <u>Working Fund, Agriculture, Forest Service (Federal Power Commission)</u> : Examination of power development lo- cated on national-forest lands.....	1,033	1,200	1,200
4. <u>Flood Control, General (Transfer to Agriculture) (Forest Service)</u> : Pre- liminary examinations and surveys on selected watersheds authorized by Flood Control Acts.....	540,214	1,396,297	—

Projects	Estimated		Estimated
	Obligated	obligations	obligations
	1939	1940	1941
5. <u>Emergency Relief, Agriculture, Administrative Expenses (Transfer from W.P.A.) (Forest Service):</u> Administrative expenses in connection with miscellaneous forestry projects.....	\$372,603	\$244,094	\$ ---
6. <u>Emergency Relief, Agriculture, Forest Service, Public Buildings, Parks, Flood Control, etc. (Transfer from W.P.A.):</u>			
(a) Mapping boundary tracing, etc...	447,517	166,788	---
(b) Miscellaneous improvements on national forests.....	2,003,828	2,383,709	---
(c) Rodent, tree insect, and tree disease control.....	380,642	353,972	---
(d) Range improvements.....	478,700	584,731	---
(e) Planting and tree nurseries.....	2,568,321	2,346,600	---
(f) Development of public camping grounds.....	863,853	263,036	---
Total.....	(a)6,742,861	(b)6,098,836	---
(a) For allocation by States, see table which follows.			
(b) For allocation by States, see table which follows.			
7. <u>Emergency Relief, Agriculture, Soil Conservation Service, Public Buildings, Parks, Utilities, Flood Control, etc. (Transfer from W.P.A.) (Forest Service):</u> For miscellaneous improvements on lands transferred to Forest Service in northeastern Washington, western Oregon, and Colorado.....	161,346	---	---
8. <u>Emergency Relief, Agriculture, Forest Service, Administrative Expenses:</u> For administration, rehabilitation project.....	4,288	4,195	4,195
Total, Supplemental Funds.....	7,874,672	7,795,643	56,416

(a) Emergency Relief Funds (Item 6) allocated 1939 as follows:

States, etc.	Allotments	States, etc.	Allotments
<u>Project Funds:</u>		<u>Project Funds:</u>	
Alabama.....	\$24,447	Montana.....	\$362,155
Alaska.....	40,880	Nebraska.....	477,548
Arizona.....	194,819	Nevada.....	85,321
Arkansas.....	60,544	New Hampshire.....	5,497
California.....	670,621	New Mexico.....	184,404

<u>States, etc.</u>	<u>Allotments</u>	<u>States, etc.</u>	<u>Allotments</u>
<u>Project Funds:</u>		<u>Project Funds:</u>	
Colorado.....	\$344,643	New York.....	\$3,544
Connecticut.....	4,278	North Carolina.....	91,032
District of Columbia...	54,612	North Dakota.....	395,209
Florida.....	27,649	Ohio.....	18,434
Georgia.....	59,400	Oklahoma.....	389,519
Idaho.....	346,136	Oregon.....	376,561
Illinois.....	23,200	Pennsylvania.....	57,768
Indiana.....	15,579	South Carolina.....	25,444
Kansas.....	367,414	South Dakota.....	441,099
Kentucky.....	58,364	Tennessee.....	30,601
Louisiana.....	45,424	Texas.....	330,583
Maine.....	2,915	Utah.....	247,428
Maryland.....	7,985	Vermont.....	9,343
Massachusetts.....	2,496	Virginia.....	44,187
Michigan.....	104,693	Washington.....	269,180
Minnesota.....	75,713	West Virginia.....	41,151
Mississippi.....	45,314	Wisconsin.....	112,999
Missouri.....	91,189	Wyoming.....	75,539
		Total.....	6,742,861

(b) Emergency Relief Funds (Item 6) allocated 1940 as follows:

<u>States, etc.</u>	<u>Allotments</u>	<u>States, etc.</u>	<u>Allotments</u>
<u>Project Funds:</u>		<u>Project Funds:</u>	
Alabama.....	\$92,000	Nebraska.....	\$403,790
Alaska.....	23,000	Nevada.....	77,612
Arizona.....	191,500	New Hampshire.....	11,900
Arkansas.....	158,239	New Mexico.....	138,000
California.....	562,412	North Carolina.....	41,100
Colorado.....	386,679	North Dakota.....	353,000
Connecticut.....	3,200	Ohio.....	14,014
District of Columbia...	48,600	Oklahoma.....	335,000
Florida.....	210,463	Oregon.....	272,020
Georgia.....	137,000	Pennsylvania.....	9,226
Idaho.....	314,952	South Carolina.....	18,000
Illinois.....	16,522	South Dakota.....	368,968
Indiana.....	9,180	Tennessee.....	22,500
Kansas.....	388,000	Texas.....	288,500
Kentucky.....	40,700	Utah.....	261,808
Louisiana.....	15,000	Virginia.....	48,800
Maine.....	3,000	Washington.....	187,744
Maryland.....	14,874	West Virginia.....	53,300
Massachusetts.....	3,200	Wisconsin.....	71,250
Michigan.....	77,099	Wyoming.....	49,922
Minnesota.....	55,321	Total.....	6,098,745
Mississippi.....	46,174		
Missouri.....	62,414		
Montana.....	212,762		

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WORK UNDER EMERGENCY ALLOTMENTS

These allotments are used for such projects as the construction and maintenance of firebreaks, forest-fire lookout houses, towers and observatories, landing fields, telephone lines, forest roads and trails, housing for forest officers, miscellaneous buildings and structures, planting, maintenance of tree nurseries, thinning of forest stands, fire prevention and control, fire-hazard reduction, construction and maintenance of improvements for recreational use of the forests, control of tree-destroying insects and diseases and of range-destroying rodents, eradication of poisonous range plants and revegetation of depleted ranges, construction and maintenance of range fences and other range improvements; surveys of forest resources such as timber, forage, water, wildlife, and related activities; surveys needed for forest activities, power-resource evaluation and appraisal, and development of the fish and game resources; studies relating to forest, range, and watershed management, protection, development, and utilization; and for other work and the purchase of equipment and supplies incident to or necessary in connection with any projects of the character indicated above.

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Allotments under Civilian Conservation Funds
(financed by War Department)

Projects	Obligated, 1939	Estimated obligations, 1940
1. National Forests (and miscellaneous)	\$13,831,051	\$12,537,484
2. Alaska	715,000	794,100
3. State, municipal, and privately owned lands	11,134,745	9,342,941
4. Puerto Rico	1,028,000	1,019,000
Total, CCC	26,708,796	23,693,525

Civilian Conservation Corps (authorized by Acts of March 31, 1933, April 8, 1935, and June 28, 1937; allotment through War Department):

	1939	1940 (estimated)
1. <u>Civilian Conservation Work on</u> <u>National Forests</u> (includes a small number of miscellaneous camps)	<u>\$13,831,051</u>	<u>\$12,537,484</u>

The number of camps on national forests on July 1, 1938, and July 1, 1939 (all camps on national forests unless otherwise indicated) were:

	<u>July 1, 1938</u>	<u>July 1, 1939</u>
Alabama	4	4
Tennessee Valley Authority	5	4
Arizona	11	11
Arkansas	11	11
California	38	36
Colorado	10	10
District of Columbia (National Arboretum)	1	-
Florida	3	3
Georgia	5	5
Idaho	29	28
Illinois	4	4
Indiana	2	2
Kentucky	6	6
Louisiana	5	4
Michigan	24	23
Minnesota	16	15
Mississippi	9	8
Missouri	9	9
Montana	12	13
Nebraska	1	1
Nevada	2	2
Navy	1	-
New Hampshire	4	6

1. The first part of the document is a list of names and addresses, which are arranged in a table-like format. The names are written in a cursive script, and the addresses are written in a more formal, printed style. The list is organized into columns, with names in the first column and addresses in the second column.

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	<u>July 1, 1938</u>	<u>July 1, 1939</u>
New Mexico	8	8
North Carolina	8	8
Tennessee Valley Authority	1	1
Ohio	2	2
Oklahoma	1	1
Oregon	17	17
Pennsylvania	4	3
South Carolina	5	5
South Dakota	8	7
Tennessee	4	4
Tennessee Valley Authority	11	11
Texas	7	6
Utah	9	8
Vermont	3	2
Virginia	10	10
Tennessee Valley Authority	2	2
Washington	16	15
West Virginia	7	5
Wisconsin	13	12
Wyoming	9	8
	<hr/>	<hr/>
Total camps	<u>357</u>	<u>340</u>
	<hr/>	<hr/>
Total, national-forest camps	336	322
Total, Navy camps	1	-
Total, Tennessee Valley Authority camps. .	19	18
Total, National Arboretum camps.	1	-
	<hr/>	<hr/>
Total	<u>357</u>	<u>340</u>

WORK UNDER FOREGOING ALLOTMENT

This allotment is used for the pay of supervisory and facilitating personnel necessary for the field work done from C.C.C. camps mainly on the national forests; also for the purchase of necessary equipment and construction materials and for miscellaneous expenses incident to the field work of the camps. The field work on the national forests includes the construction of physical improvements needed for the protection and administration of the forests, tree planting, thinning of young stands of timber, destruction of undesirable timber species, rodent control, etc.

	<u>1939</u>	<u>1940 (estimated)</u>
2. <u>Civilian Construction Work in</u>		
Alaska	<u>\$715,000</u>	<u>\$794,100</u>

WORK UNDER FOREGOING ALLOTMENT

This allotment (Alaska) is used for pay and allowances to dependents of enrolled members of the Civilian Conservation Corps and for salaries and

1. The first part of the paper is devoted to a general discussion of the problem of the existence of solutions of the system of equations (1) for arbitrary values of the parameters α and β . It is shown that the system (1) has solutions for arbitrary values of the parameters α and β if and only if the condition $\alpha + \beta = 1$ is satisfied. In this case the solutions are given by the formulas (2).

2. In the second part of the paper the problem of the stability of the solutions of the system (1) is considered. It is shown that the solutions of the system (1) are stable with respect to the initial conditions if and only if the condition $\alpha + \beta = 1$ is satisfied. In this case the solutions are given by the formulas (3).

3. In the third part of the paper the problem of the asymptotic behavior of the solutions of the system (1) is considered. It is shown that the solutions of the system (1) tend to zero as $t \rightarrow \infty$ if and only if the condition $\alpha + \beta = 1$ is satisfied. In this case the solutions are given by the formulas (4).

4. In the fourth part of the paper the problem of the periodicity of the solutions of the system (1) is considered. It is shown that the solutions of the system (1) are periodic if and only if the condition $\alpha + \beta = 1$ is satisfied. In this case the solutions are given by the formulas (5).

5. In the fifth part of the paper the problem of the boundedness of the solutions of the system (1) is considered. It is shown that the solutions of the system (1) are bounded if and only if the condition $\alpha + \beta = 1$ is satisfied. In this case the solutions are given by the formulas (6).

6. In the sixth part of the paper the problem of the uniqueness of the solutions of the system (1) is considered. It is shown that the solutions of the system (1) are unique if and only if the condition $\alpha + \beta = 1$ is satisfied. In this case the solutions are given by the formulas (7).

7. In the seventh part of the paper the problem of the regularity of the solutions of the system (1) is considered. It is shown that the solutions of the system (1) are regular if and only if the condition $\alpha + \beta = 1$ is satisfied. In this case the solutions are given by the formulas (8).

8. In the eighth part of the paper the problem of the smoothness of the solutions of the system (1) is considered. It is shown that the solutions of the system (1) are smooth if and only if the condition $\alpha + \beta = 1$ is satisfied. In this case the solutions are given by the formulas (9).

9. In the ninth part of the paper the problem of the differentiability of the solutions of the system (1) is considered. It is shown that the solutions of the system (1) are differentiable if and only if the condition $\alpha + \beta = 1$ is satisfied. In this case the solutions are given by the formulas (10).

10. In the tenth part of the paper the problem of the integrability of the solutions of the system (1) is considered. It is shown that the solutions of the system (1) are integrable if and only if the condition $\alpha + \beta = 1$ is satisfied. In this case the solutions are given by the formulas (11).

wages of extra supervisory and clerical personnel needed in connection with the work. It is also used for the purchase of clothing, subsistence, supplies, and camp equipment required for enrolled men of the Corps and for the purchase of construction materials used in the work. Classes of work done under this allotment include construction of trails, minor roads, bridges, water development and improvement, and miscellaneous administrative improvements; roadside clearings and public campground improvement; estimating timber resources; and other miscellaneous work. The men engaged in the work are recruited from the unemployed local residents without regard to age.

	<u>1939</u>	<u>1940</u> (Estimated)
3. <u>Civilian Conservation Work on State,</u>		
<u>Municipal, and Privately Owned Forest</u>		
<u>Land.</u>	<u>\$11,134,745</u>	<u>\$9,342,941</u>

Number of camps by States on July 1,
1938, and July 1, 1939:

	<u>July 1, 1938</u>	<u>July 1, 1939</u>
Alabama	3	3
Arkansas.	6	6
California.	7	7
Connecticut	10	10
Delaware.	4	-
Florida	6	5
Georgia	6	6
Idaho.	4	4
Illinois.	6	1
Indiana	12	5
Iowa.	8	3
Kentucky.	8	6
Louisiana	11	5
Maine	5	5
Maryland.	10	7
Massachusetts	10	12
Michigan.	13	12
Minnesota	11	11
Mississippi	3	4
Missouri.	7	3
Montana	1	1
New Hampshire	3	5
New Jersey.	13	10
New York.	31	32
North Carolina.	5	5
Ohio	12	5
Oklahoma	2	2
Oregon	9	9
Pennsylvania.	33	33
Rhode Island.	2	2
South Carolina.	8	8

1. *Phragmites australis* (Cav.) Trin. ex Steud.

	<u>July 1, 1938</u>	<u>July 1, 1939</u>
Tennessee	4	4
Texas.	6	6
Vermont	6	6
Virginia.	12	10
Washington.	8	7
West Virginia	8	7
Wisconsin	12	12
	<hr/>	<hr/>
Total camps on State lands, etc .	<u>325</u>	<u>279</u>

WORK UNDER FOREGOING ALLOTMENT

This allotment is used for the payment of expenses incurred in the conduct of Civilian Conservation Corps work on State, municipal, and privately owned lands, including the purchase of supplies, materials, and equipment used in the work, for payment of salaries and wages of supervisory personnel directing the work of the enrolled men, and for other necessary expenses incident to the work.

The work being accomplished under this allotment includes the protection of State and private forest land from fire by construction of firebreaks, lookout towers, communication systems, truck trails, tool sheds, guard houses, and the fighting of forest fires; protection of State and privately owned forests from the epidemic spread of forest insects and tree diseases; forest cultural measures to improve the forest growth on State-owned lands; and the construction of simple dams and the planting of trees, grass, etc., for the control of erosion and flash run-off at the headwaters of streams.

	<u>1939</u>	<u>1940</u>
4. <u>Civilian Conservation Work in</u>		(estimated)
<u>Puerto Rico.</u>	<u>\$1,028,000</u>	<u>\$1,019,000</u>

WORK UNDER FOREGOING ALLOTMENT

This allotment (Puerto Rico) is used for the payment of authorized enrollees and the supervisory personnel engaged in the technical direction of the work projects on the Luquillo National Forest and the insular forests and for the purchase of equipment and supplies incident to the work.

The work projects comprise the construction and maintenance of roads and trails, production of nursery stock, making new forest plantations and thinning old ones, forest thinnings to improve the timber stands within the national and insular forests, and development of a recreational area within the national forest. With a population of 1,500,000, the unemployment situation in Puerto Rico has been acute and,

since the enrollment of the 2,350 men has been on a pro rata basis from the 72 insular municipalities, the C.C.C. work has played its part in giving a measure of relief. Camps are not established as they are in the States, since a large proportion of the enrollees live at home and go to and from the work projects.

PASSENGER-CARRYING VEHICLES

The authorization for the purchase of passenger-carrying vehicles for the Forest Service from the appropriation "Salaries and Expenses" and related appropriations contemplates an increase of \$27,372 (\$61,628 in 1940, \$89,000 estimates for 1941) for this purpose. This \$89,000 will permit the needed replacement of 144 vehicles at a net average cost of \$618 when exchange allowances are taken into account.

From the appropriation "Forest Roads and Trails" for the fiscal year 1940 an increase of \$6,750 (\$9,755 in 1940, \$16,505 in 1941) for passenger-carrying vehicles is recommended. All the 25 vehicles which it is proposed to purchase from this authorization are needed for replacement of vehicles now in use at a net average cost of \$660 when exchange allowances are taken into account.

It is estimated that the average mileage of the cars to be replaced, as of June 30, 1940, will be in the neighborhood of 55,000 miles.

FOREST ROADS AND TRAILS

(Carried under "General Public Works" in 1941 Estimates)

Appropriation Act, 1940	\$10,000,000
Budget Estimate, 1941	<u>10,000,000</u>

PROJECT STATEMENT

Project	1939	1940	1941
		(estimated)	(estimated)
Forest roads and trails	\$14,000,000	\$10,000,000	\$10,000,000

CHANGES IN LANGUAGE

It is proposed to add a proviso to this paragraph authorizing the use of not to exceed \$50,000 for the purchase of land and construction of a building at Missoula, Montana, for the storage and repair of road and trail equipment. At the present time a temporary warehouse building, which is in a bad state of repair and located on leased land, is being utilized for this purpose. The new building would be located adjacent to the Department of Agriculture consolidated repair shops. It will be used for the storage of road building equipment and supplies used on forest highway work in Montana by the Public Roads Administration. It will also provide for servicing of automobiles and light trucks.

WORK UNDER THIS APPROPRIATION

This appropriation is made for Forest roads and trails under the provisions of Section 23 of the Federal Highway Act. The purpose is twofold (1) to provide the transportation system required for proper and economical administration, protection, development and utilization of the National Forest land and resources; and (2) to assist the States and counties in transportation development because of the loss of taxable revenues from the forest land. The law provides for dividing the total appropriation into two funds - the Forest Road Development Fund and the Forest Highway Fund. Also the law requires that, in accordance with specified factors each fund shall be apportioned among the 40 States and two Territories in which national forests are located. For each fund, service to the forests is essential to qualifying for expenditure.

No expenditure is approved except for roads and trails on the planned national-forest transportation system. The planning is conducted on scientific principles and is carefully and systematically done. The

planned system includes only those roads and trails which a thorough investigation and analysis show will be needed within ten years for the administration, protection, development and utilization of the forests and for public travel into and through the forests. It has been definitely planned to exclude roads from 76 areas ranging in size from about 50,000 to 1,000,000 acres and with a total acreage of about 15,000,000 acres.

Because of the vast area in the national forests--approximately one-tenth that of the United States--and since they contain resources of great value and of many kinds, the total mileage in the planned system is great but the intensity is less than for public road systems outside the boundaries. On June 30, 1939, the planned system included 24,817 miles of Forest Highways, 114,743 miles of Development truck trails and 154,791 miles of foot and horse trails. This means an average of about one mile of highway and truck trail for an area of about 3 square miles.

What will be needed in the future for fire protection is needed now. But for other resources and for public travel the needs are not constant. Due to increased utilization of forest products and resources and to the necessity of adequate erosion control, because of the transportation needs in areas recently added to the forests and as a result of public demands for greater mileage and higher travel speed, for more attractive roads and for roads carrying a larger traffic volume with greater safety, many changes must be made in the planned mileage and in the estimates of required expenditure.

For the mileage on the planned road and truck trail system roughly one-half is now of satisfactory standard and the system of foot and horse trails is about 70 per cent adequate. During the past few years accomplishments made possible by Federal appropriations and cooperative contributions have hardly kept pace with the increase in the required mileage and the expenditure necessary for construction and betterment. Also the areas added to the forests are usually very deficient in needed roads and trails and largely a complete transportation system must be provided.

Cooperation is not required by law but may be accepted. About \$500,000 was given to the Department for expenditure during the fiscal year 1939. Independently but confined almost entirely to the Forest Highway System the total expenditure by the States and counties has far exceeded that from the Forest Road and Trail Funds. Since it is generally agreed that the construction and maintenance of the Development System is a Federal responsibility, comparatively little cooperative assistance is received.

The approved Development System includes roads and trails necessary to the forest and of greater value for the forests than for other purposes. Transportation is essential to practically every activity of the Forest Service.

Efficient administration of the forests is dependent upon a widespread transportation system. It is obvious that in fire suppression quick detection and speedy arrival at the fire are essential in preventing large conflagrations and losses and heavy expenditures for suppression. For fire detection, truck trails to lookout towers and similar points must be provided. Roads and trails also offer additional opportunities for detecting and locating fires. The greatest value is for fire suppression in connection with transporting men, materials, tools, equipment, and supplies. That truck trails and foot trails are practically indispensable and that through their availability suppression costs and fire damages have been greatly reduced has been demonstrated repeatedly. Furthermore since the Development work is supervised and directed by the Forest Service it is possible to closely coordinate it with fire suppression. The men engaged in construction and maintenance are trained in suppression work and when needed for fire suppression, the road or trail work is stopped and the crew is sent to the fire. Also a considerable portion of the road equipment is suitable for and is used in constructing fire lines and other suppression work.

The Development Roads are also essential to the utilization of the timber and range resources. Bodies of timber approved for sale are unattractive unless easy means of access are available. Unlike the past when railroads and rivers were used in transporting the logs, practically all transportation of logs, lumber and cord wood from the woods or mill to the railroad, mill or point of use is now by road. The distances vary from a few miles to over 200 and the loads from a cord or two for home use or local sales to many tons of logs or lumber in large scale operations.

Prior to some 10 years ago, the use of roads in utilizing the grazing resources of forest land was restricted largely to administration and management of the range by stockmen and forest officers. Since then a big change has occurred. Instead of driving sheep to the market or shipping point the present practice is to use trucks. The result is a large saving in cost and time and in losses in weight or through death. Hauling of sheep and lambs to the range and truck transportation of cattle are new and increasing uses.

Small towns, settlements, individual homes, water power, irrigation, water supply, mining and similar developments need roads during and after construction. The largest use of the Development roads and truck trails from the standpoint of number and total car miles is for recreation. Many millions use the Forest roads very extensively in traveling to and from resorts, camps, picnic areas and summer homes, in enjoying the scenery and for fishing and hunting. For such purposes the amount of use is fast increasing.

In the past four years, increased utilization made necessary the addition of about 15,000 miles to the planned Development road system. During that period a total of about 13,500 miles of road were constructed or improved. Of this total 3,415 miles were financed from the regular or emergency Development appropriations and the balance was provided through utilizing the Civilian Conservation Corps. The amount of aid obtained from CCC on road and trail work is rapidly decreasing and is now only about

16 per cent of that in 1934. Also because of reduced appropriations and increased demands on the camp allotments, CCC cannot be used on road construction unless the CCC fund is supplemented from the Development Fund.

From the recommended appropriation, \$220,000 will be available for such supplementing and as a result it is estimated that about 245 miles of truck trail will be brought up to satisfactory standard. This expenditure will be made during the present fiscal year and the work will be confined to projects where construction or betterment work is now under way. According to present estimates similar work during the fiscal year 1941 is not planned. Under present conditions it is expected that CCC aid in road and trail work will be restricted to those classes of work--bank sloping and vegetation, roadside clearings, etc.--which require a maximum use of hand labor and a minor expenditure for supplies, materials and the operation and maintenance of equipment.

The required expenditures for maintenance have increased rapidly during the past few years because of added mileage of constructed roads and trails and the necessity of maintaining some 13,500 miles of existing, substandard roads which are needed and used for forest business or by the local people. Not only do the latter fail to give the required service but the maintenance cost per mile greatly exceeds that for a road of satisfactory service and construction standard. Accordingly, except when the need for additional roads and trails is so urgent that immediate attention is necessary, it is the policy to utilize such of the regular appropriation as is available for construction or improvement work, in bringing existing roads up to satisfactory construction and service standard.

The Development Fund's share of the \$10,000,000 appropriation is \$3,225,000. Excepting the \$220,000 fiscal year 1940 expenditure for construction and improvement work in cooperation with CCC, the entire amount will be expended in the maintenance of 47,608 miles of truck trail and 74,841 miles of foot and horse trail. In addition and in order that all necessary maintenance work can be done, it is hoped that CCC will be able to maintain 19,505 miles of truck trail and 6,890 miles of foot and horse trail,

The approved Forest Highway System includes roads serving the Forests but of greater value for public use than for the forest administration, protection, development or utilization. However the value of certain forest highways to the forests themselves exceeds the value to the forests of certain Development roads. Each forest highway is essential to the forests although frequently for the forests themselves a lower standard would suffice.

The Forest Highway System in itself is a complete transportation system of Federal Aid, State, county, and community roads. Supplemented by the Development System, the planned development is similar to a complete system of primary and secondary highways and feeder roads--farm-to-market, farmers and property roads--in other sections of the United States.

Roughly 39 per cent--9,556 miles--of the planned Forest Highway System is on the Federal Aid or primary highway system. The forest sections of these through inter-State roads are essential links and unless constructed to a standard comparable to other sections outside the forests, the effectiveness and service value of the entire route is lessened or lost. 38 per cent of the planned forest highway--9,529 miles--is on the State system. On these the total route lengths are less, the travel is more local in character and is composed of a larger proportion for local resource development and use, State or local business and inter-city or inter-town travel. Full benefit from expenditures outside of the forests is not rendered and the planned service to travel is not obtained unless the forest sections are improved to the required standard. The county and community roads--5,732 miles in length and 23 per cent of the planned system--are largely of the farm-to-market type. These are the feeders to the State system and are essential to the people and communities living within or near the forests for local business, intercommunity travel and for resource development and utilization. While these from the standpoint of traffic volume are a minor part of the entire public highway system, they very largely serve as the trunk road system for the forest development roads.

Within the past four years, the growth in the amount and character of road use has necessitated the addition of 3,893 miles to the planned Forest Highway System. During that period, 2,975 miles were constructed or improved using the regular and emergency forest highway appropriation. But in addition there was much independent State and county construction and betterment and minor construction work by CCC. On June 30, 1939, the percentage of satisfactory standard to total planned mileage was 50 as against 48 for four years earlier, an annual gain of about one-half per cent.

While the service and construction standard of the forest section of certain highways, particularly those on the Federal Aid and primary State system, is as good as on sections of the same highways outside the forest, the Forest Highway System as a whole is inferior in construction standard and service value to the public road systems outside and near the forest. The extent to which this disparity exists in different States varies considerably.

Of the recommended appropriation of \$10,000,000, the share of the Forest Highway Fund is \$6,775,000. Of this total, the financing of construction contracts previously awarded or which will be awarded very soon will require the expenditure of \$1,708,488 during the present fiscal year. The balance of \$5,066,512 will be expended during the fiscal year 1941--\$1,150,000 for maintenance and general administration; \$3,716,512 to complete the financing of contract obligations incurred against the appropriation authorization for the fiscal year 1940; and \$200,000 in financing a continuation of three forest highways being constructed by Federal prisoners from camps in Arizona, Idaho, and West Virginia. Expressing this in another way, the plans for expending the Forest Highway Fund contemplate (1) using the amount appropriated from the fiscal year 1940 appropriation authorization to complete the financing of contract obligations incurred against that authorization; (2) that essential maintenance and administrative expenses will be financed from the appropriation from the authorization for the fiscal year 1941; and (3) that, except for the construction by Federal prisoners, no part of the appropriation from the 1941 authorization will be obligated for new or additional construction work. The amount to be expended on the construction contracts will be equivalent to the entire construction cost of approximately 60 miles.

For the entire \$10,000,000 appropriation, and including both the Forest Road Development and the Forest Highway Funds, the following is a summation of the proposed expenditures:

	<u>Year of Appropriation Authorization</u>	
	<u>1940</u>	<u>1941</u>
Expenditures in fiscal year 1940:		
Construction contracts	\$1,708,488	- -
Construction and betterment work		
under way	220,000	- -
Total for year	<u>1,928,488</u>	<u>- -</u>
Expenditures in fiscal year 1941:		
Construction contracts	3,716,512	- -
(fiscal year 1940 authorization)		
Continuation of construction at		
3 Federal prison camps	- -	\$200,000
Maintenance and administration ...	<u>1,355,000</u>	<u>2,800,000</u>
Total for year	<u>5,071,512</u>	<u>3,000,000</u>
Total for both years..	<u>7,000,000</u>	<u>3,000,000</u>
Total for both appropriation authorizations	\$10,000,000	

SUPPLEMENTAL FUNDS

Project	Obligated, 1939	Estimated Obligations, 1940
<u>Emergency Relief, Agriculture,</u>		
Forest Service (Transfer from		
W.P.A.):		
Forest Roads and Trails:		
Fire preparedness	\$912,798	\$800,000

BUREAU OF AGRICULTURAL CHEMISTRY AND ENGINEERING

(a) GENERAL ADMINISTRATIVE EXPENSES

Appropriation Act, 1940.....	\$112,800
Deduct allotment for transfer in 1941 Estimates to "General Administrative Expenses," Bureau of Plant Industry (incident to transfer of appropriation for "Fertilizer Investigations" to that bureau).....	- 7,500
Total available, 1940.....	105,300
Budget Estimate, 1941.....	105,500
Increase.....	<u>200</u>

PROJECT STATEMENT

Projects	1939	1940 (Estimated)	1941 (Estimated)	Increase
1. General Administration and business service.....	\$104,696	\$105,300	\$105,300	---
2. Additional for administra- tive promotions.....	---	---	200	+\$200(1)
Unobligated balance.....	604	---	---	---
Total.....	105,300	105,300	105,500	+ 200

INCREASE

(1) \$200 additional estimated for administrative promotions in accordance with the plan which is being uniformly applied in the budget estimates for 1941.

WORK UNDER THIS APPROPRIATION

This appropriation provides for the salaries and expenses of the Office of the Chief of Bureau and for the administrative units of business management, information and editorial, audits and bookkeeping, estimates and reports, personnel, equipment and supplies, files, and miscellaneous services and records.

(b) AGRICULTURAL CHEMICAL INVESTIGATIONS

Appropriation Act, 1940	\$411,500
Budget Estimate, 1941	<u>379,906</u>
Decrease	<u>31,594</u>

PROJECT STATEMENT

Projects	1939	1940 (Estimated)	1941 (Estimated)	Increase or decrease
1. Cereals, fruits, vegetables, etc., investigations.....	\$153,250	\$173,672	\$151,298	-\$22,374(1)
2. Sugars, starches, and fats investigations	116,537	118,280	117,280	- 1,000(2)
3. Protein and nutrition inv.	27,828	27,960	27,960	---
4. Fundamental investigations in chemistry, microbiology, and pharmacology relating to agricultural products...	70,743	72,068	72,068	---
5. Chemical weed eradication investigations.....	19,158	19,520	11,000	- 8,520(2)
6. Additional for administrative promotions.....	---	---	300	+ 300(3)
Unobligated balance	4,984	---	---	---
Total appropriation	392,500	411,500	379,906	- 31,594

INCREASES OR DECREASES

The decrease of \$31,594 in this item for 1941 consists of :

(1) A reduction of \$22,374 under project 1, "Cereals, fruits, vegetables, etc., investigations", including \$19,000 due to the dropping of a nonrecurring item provided in 1940 for the construction of an addition to the U. S. Citrus Products Laboratory, Winter Haven, Florida, and \$3,374 through curtailment of work.

(2) A reduction of \$9,520 through curtailment of work under projects 2 "Sugars, starches and fats investigations" and project 5, "Chemical weed eradication investigations".

(3) \$300 additional estimated for administrative promotions in accordance with the plan which is being uniformly applied in the Budget Estimates for 1941 .

CHANGE IN LANGUAGE

The clause in the 1940 item setting aside \$19,000 for the construction and equipment of an addition to the United States Citrus Products Laboratory, Winter Haven, Florida is omitted, since this transaction will be completed during the current fiscal year.

WORK UNDER THIS APPROPRIATION

General -- The purposes of the investigational work under this appropriation, with suitable cooperation with other agencies when required, are to improve the quality of farm crops and products therefrom for non-surplus consumer uses, chiefly for food and feed purposes, and to obtain better adaptation of crops and products to specific market requirements; to investigate the constituents of and develop useful uncultivated plants into commercial crops; to obtain chemical and technological information necessary for development of minor crops in order to increase agricultural diversification; to devise means of preventing or controlling deterioration of crops during the period between harvesting and processing; to reduce losses from deterioration and spoilage of food and other agricultural products; to devise and develop suitable methods of preserving farm products and to establish a basis for selection of the crops and crop varieties in various areas which are most suitable for preservation; and to develop methods for disposal of wastes from food processing plants.

This work involves basic research on the chemical nature of the numerous organic and inorganic constituents of agricultural products, and technological application of the knowledge thus acquired to the solution of practical problems of utilization. Investigations are conducted on the chemistry, technology, processing, and utilization of cereals, fruits, and vegetables, on carbohydrate crops and products (sugars, starches, and miscellaneous carbohydrates), oils, fats, and waxes, and on proteins and vitamins. Fundamental investigations involving chemical, biochemical, microscopic, and microbial studies are conducted on foodstuffs in all phases of their evolution from food plants and raw materials to the finished manufactured products. Studies are also being conducted on problems dealing with the production and use of chemicals for the control of noxious weeds.

1. Cereals, Fruits, Vegetables, etc., Investigations. -- Work under this project is directed towards increasing the efficiency of recognized methods and developing new methods in the processing and preservation of food products; in the prevention of spoilage; and in the utilization of culls, and wastes for the manufacture of food and other products. Cereal investigations include the study of problems in baling and malting, with special reference to improving quality of cereal products and the reduction of large losses from spoilage such as is caused by staling and rancidity. Fruit and vegetable investigations are concerned with the various types of food preservation, economical utilization of culls and the development of valuable byproducts. The portion of the fruit and vegetable crops graded as culls often constitutes from twenty to thirty percent of the total crops and represents that much loss unless methods of profitable utilization are developed. One of the present problems of outstanding importance to the fruit industry is the satisfactory preservation of fruit juices. The quality of fruit suitable

for juice extraction is not suitable for direct sale, yet is highly palatable and of great dietary and commercial value. In connection with the utilization of vegetables, investigations of methods of preservation by freezing are of the greatest importance. Investigations are also conducted to improve processes for making pickles and allied products. Foods and food products with a value of more than \$3,000,000,000 come within the field served by this project. It is the aim of the work to increase this valuation by expanding the processing of farm products, thereby extending the market for raw materials and adding to the farm price.

2. Sugars, Starches, and Fats Investigations. -- This work consists of chemical and technological investigations on the carbohydrate (sugars, starches, etc.) constituents of crops and derived farm products (such as sugarcane, sugar beets, honey, maple products, farm-made sugarcane and sorghum sirups, sweet and white potatoes and other starchy plants, and plants containing miscellaneous carbohydrates), and on fats, oils and waxes from crops. The object of this work is to increase farm income from those crops whose value is determined largely by their content of sugars, starches and oils. Investigations are conducted under this project to determine the identity, properties, and content of the carbohydrate and oil, fat and wax constituents of various crops; to ascertain the factors which influence yield and quality of these constituents and derived products; to devise means which will insure better and more uniform quality and better adaptation to market requirements; to investigate causes of and devise means of controlling deterioration of such crops during the period between harvesting and processing; to obtain the chemical data required for development of minor crops; to investigate the constituents of and to find means of commercially developing uncultivated plants with a view to providing new and valuable crops for diversification. The work on these crops and products, which represent a value of several hundred million dollars annually, is also of benefit to processors and consumers of these agricultural commodities.

3. Protein and Nutrition Investigations. -- Under this project chemical and biological investigations are made of the nutritive value of foods and feeds with particular reference to their protein and vitamin content, two of the most important factors in human and animal nutrition. Proteins differ greatly in their food value. They are complex compounds made up of over twenty constituents called amino acids. Ten of these are now known to be essential for growth and nutrition. When any one is lacking in the diet specific nutritional derangements result. The chief proteins of some of the most important foods are deficient in one or more amino acids. Others contain them in abundance. Exact information on the amino acid composition of proteins is meager and fragmentary. It is the purpose of this work to conduct chemical investigations and feeding studies with laboratory animals to determine the properties and amino acid composition and digestibility of food proteins so that amino acid deficiencies in one foodstuff or food can be corrected by proper supplementation with other proteins so as to provide a balanced protein diet. Extension of our knowledge of the chemistry of proteins is important for the farmer for the efficient feeding of farm animals and for the best utilization of his crops; for the correction of much of the nutritional deficiency prevalent in the United States resulting from inadequate protein in the diet with respect to both quantity and quality; for advancement in the fields of enzymes, serums, antitoxins, and

immunization against diseases. Investigation of vitamins includes the study of methods and technique of vitamin assay, and studies of the effect upon vitamins of certain commercial processes used in the manufacture of foods. Some of the more important studies that are being conducted include investigation on the effect of storage under different conditions upon the chemical properties and nutritional value of the proteins of wheat, corn, soybeans, and their milled products, a subject of great economic importance in view of the large quantities of grain stored under the provisions of the "Ever Normal Granary," and storage of surplus crops; a research to isolate and determine the chemical structure of the organic selenium compound in the protein of toxic grains grown on seleniferous soils in the United States--these grains cause great losses to owners of farm animals; studies to develop new methods for the chemical determination of amino acids in staple foods; biological studies to determine the comparative protein nutritional value of corn, wheat, oats, and other seeds by means of a standardized method recently developed.

4. Fundamental Investigations in Chemistry, Microbiology, and Pharmacology Relating to Agricultural Products. -- This project involves chemical, biochemical, microscopic and microbial studies of foodstuffs, in all phases of their evolution to finished manufactured products. It is the purpose of this work to conduct specific fundamental studies that because of their nature cannot be undertaken either by the individual food manufacturers or food trade organizations. Among the more important lines of work being conducted are the following: Research on the microbial spoilage of preserved foods -- a phenomenon of widespread occurrence and of special importance now because of the rapid development of new processes for preserving foods; determination of the toxic effects which may result from consumption of human foods containing naturally occurring or artificially added ingredients, as antimony and cadmium; the pharmacology of naturally occurring ingredients in foods, as naringin and hesperidin in citrus fruits; isolation and identification of special constituents of plants and plant products that appear to be of special value in nutrition or in the arts -- for example, the ursolic acid of apple pomace and other fruit waste; studies of the color formation of apples and the deterioration of color in tomatoes -- factors of important bearing on the value of the products; research on the nature of various enzyme actions, and their relation to growth, spoilage, curing and preservation of agricultural products. A proper understanding of the factors responsible for the biochemical changes in food plants and products is essential in preventing losses occurring in the handling, storing, processing, and consumption of farm products. Such knowledge can be directly applied to the improvement of processes which will enhance the quality and edibility of these products with resultant increase in their uses and in the returns to the farmers.

5. Chemical Weed Eradication Investigations. -- Work under this project is directed toward the synthesis, production, development, and application of chemicals for eradication of the bindweed and other noxious weeds. Weeds cost the American farmers millions annually, through reduced yields and quality of crops and increased cost of farming. Present investigations include (a) study of the economics and methods of manufacture of recognized chemical agents for eradication of noxious weeds, with a view toward reducing

cost of these chemical agents to the farmer; and (b) the preparation and testing of new herbicides, which program is carried out in cooperation with the Bureau of Plant Industry. The knowledge thus gained can be used to reduce existing weed infested areas, thereby increasing farm revenues and land values.

SUPPLEMENTAL FUNDS

Projects	Obligated: 1939	Estimated obligations 1940	Estimated obligations 1941
Arbitration of Smelter-Fumes Controversy, United States and Canada (Transfer to Ag- riculture) (Bureau of Chemistry and Soils) (Bureau of Agricultural Chemistry and En- gineering): For smelter-fumes investiga- tions to determine damage to crops and forests in the State of Washington.....	\$556	\$9,444	---
Expenses, Payment of Indemnity Received from Canada for Damage by Smelter Fumes (Transfer to Agriculture) (Bureau of Chemistry and Soils) (Bureau of Agricul- tural Chemistry and Engineering): Exam- ination and certification of claims aris- ing from smelter-fumes damages.....	11,768	---	---
Total, Supplemental Funds.....	12,324	9,444	---

(c) INDUSTRIAL UTILIZATION OF FARM PRODUCTS AND BYPRODUCTS

Appropriation Act, 1940.....	\$191,200
Deduct allotment for transfer in 1941 Estimates to "Salaries and Expenses", Office of the Solici- tor (for services in connection with patent ap- plications).....	- 1,600
Total available, 1940.....	189,600
Budget Estimate, 1941.....	120,300
Decrease.....	<u>69,300</u>

PROJECT STATEMENT

Projects	1939	1940 (Estimated)	1941 (Estimated)	Increase or decrease
<u>Industrial Utilization of Farm Products and Byproducts:</u>				
(a) Hides and skins inves- tigation.....	\$12,084	\$12,207	\$6,935	-\$5,272(1)
(b) Tanning materials and tanning processes inves- tigations.....	16,120	16,283	9,250	- 7,033(1)
(c) Leather investigations	7,545	7,621	4,329	- 3,292(1)
(d) Wastes investigations	33,660	34,000	34,000	---
(e) Biological stain inves- tigations.....	481	486	486	---
(f) Fermentation investiga- tions.....	57,964	58,549	38,056	-20,493(1)
(g) Lignin investigations..	12,065	12,187	6,923	- 5,264(1)
(h) Chemical conversion of oils, fats and waxes.....	24,272	24,517	13,928	-10,589(1)
(i) Plastics investigations	10,618	10,725	6,093	- 4,632(1)
(j) Motor fuels from agri- cultural sources.....	12,895	13,025	---	-13,025(2)
(k) Construction of labor- atory at Weslaco, Texas...	24,663	---	---	---
(l) Additional for admin- istrative promotions.....	---	---	300	+ 300(3)
Unobligated balance.....	2,233	---	---	---
Total appropriation.....	214,600	189,600	120,300	-69,300

INCREASES OR DECREASES

(1) The decreases under work projects "a" to "i", inclusive, as listed in the above table, totaling \$56,575, contemplate the continuation of these activities in 1941 on approximately a 7-months basis, in order to coordinate the research program of the Bureau and eliminate possible duplication of existing projects and activities to be undertaken at the Regional Research

Laboratories. The decreases shown reflect the present allotments on approximately a seven months' basis, with the exception of the decrease for "Fermentation Investigations", which is computed on the basis of \$47,449 instead of the total project allotment of \$58,549, since \$11,100 of the amount allotted under this item is being used at the Agricultural Byproducts Laboratory at Ames, Iowa, which activity will not be affected.

(2) A reduction of \$13,025 due to discontinuance of work under project (j) "Motor fuels from agricultural sources," inasmuch as definite plans have been made to inaugurate very promptly research on this particular problem at the Northern Regional Research Laboratory, Peoria, Illinois.

(3) \$300 additional estimated for administrative promotions in accordance with the plan which is being uniformly applied in the Budget Estimate for 1941.

WORK UNDER THIS APPROPRIATION

The work under this appropriation is concerned with the betterment of the economic status of agriculture through conversion of its present crops and new crops into chemicals and other materials needed by industry, and improvement in the quality, recovery, preservation and use of farm products, byproducts and wastes, employing for these purposes chemical, physical, and biological methods, including the use of and changes produced by yeasts, bacteria, molds and fungi. This work embraces the conservation and improvement of agricultural raw materials used annually in the production of some \$400,000,000 worth of leather, through the raising of better hides and skins and more efficient methods for preserving these raw products; better methods of tanning; production of more serviceable leathers, and development, as new crops, of domestic tanning materials, to supplement our dwindling national supplies; salvaging a yearly production of some 175,000,000 tons of straw, cornstalks, hulls and similar agricultural byproducts by conversion into pulp, paper, pressboard, industrial cellulose and its derivatives; study of the structure and chemistry of lignin in search of industrial outlets for approximately 30,000,000 tons of lignin now produced annually; development and standardization of biological stains required in the study of plant and animal diseases and all biological research; production from oils, fats and waxes of derivatives that may find valuable applications in industry; development of synthetic resins, plastics, moulded, and formed articles from agricultural raw materials; and production of organic chemicals and solvents from agricultural crops and byproducts.

(d) AGRICULTURAL ENGINEERING INVESTIGATIONS

Appropriation Act, 1940	\$349,469
Budget Estimate, 1941	349,669
Increase	<u>200</u>

PROJECT STATEMENT

Projects	1939	1940 (Estimated)	1941 (Estimated)	Increases or decreases
1. Advice and assistance.....	\$27,393	\$27,700	\$25,900	-\$1,800 (1)
2. Farm mechanical equipment..	88,064	89,300	96,300	+ 7,000 (2)
3. Farm structures and related investigations.....	81,515	82,900	78,900	- 4,000 (1)
4. Machinery for processing farm products	74,873	76,200	88,369	+12,169 (3)
5. Farm operating efficiency investigations.....	13,321	13,369	---	-13,369 (1)
6. Rural electrification in- vestigations	28,463	30,000	30,000	---
7. Dust explosion and fire prevention.....	39,466	30,000	30,000	---
8. Additional amount for ad- ministrative promotions.....	---	---	200	+ 200 (4)
Unobligated balance	6,474	---	---	---
Total	359,469	349,469	349,669	+ 200

INCREASES OR DECREASES

The net increase of \$200 in this item for 1941 is the result of:

(1) A reduction of \$19,169 through curtailment of work under projects 1 ("Advice and assistance") and 3 ("Farm structures and related investigations") and the discontinuance of work under project 5 ("Farm operating efficiency investigations").

(2) A net increase of \$7,000 for "Farm mechanical equipment investigations" including:

(a) A reduction of \$3,000 through curtailment of work under this project.

(b) An increase of \$10,000 to construct a garage and work shop at the Farm Tillage Machinery Laboratory, Auburn, Alabama, to house trucks, automobiles and tractor and provide space for storage for experimental equipment and welding shop. At present space in the laboratory building, which is urgently needed for shop and laboratory equipment, is being used to house trucks, automobiles, and tractor. The proposed facilities will release this

space for the installation of equipment which should be removed from the present overcrowded shop, as well as provide space for the installation of other much-needed new equipment.

(3) A net increase of \$12,169 under the project "Machinery for processing farm products," including:

(a) A reduction of \$2,831 through curtailment of work under this project.

(b) An increase of \$15,000 to construct a water tower fire protection system at the United States Cotton Ginning Laboratory, at Stoneville, Mississippi, to protect Government buildings and scientific equipment representing a value in excess of \$250,000.

The Cotton Ginning Laboratory is located adjacent to the Mississippi Delta Branch Experiment Station. The village of Stoneville is not incorporated and has no water, light, or sanitary or police service. The Cotton Ginning Laboratory secures electric power from a 23,000-volt power line located on the south bank of Deer Creek adjacent to the laboratory. From this power line low voltage current is distributed to the Laboratory and the Experiment Station.

The Delta Branch Experiment Station at the present time has a small brick pump house located on the north bank of Deer Creek with a motor and centrifugal pump capable of delivering approximately 200 gallons of water per minute and operating from electric current supplied through the motor at the Laboratory site. A 4-inch fire main extends from this pump house to the Laboratories and to the Federal dwelling site, the size of threads and hose couplings being interchangeable with those of the two nearby towns. Deer Creek is not a flowing stream and the water is badly polluted by sewage. At times it reaches such a low level that it cannot be depended upon as a source of water for fire fighting purposes. This electric service also is subject to frequent disruption from inclement weather, accidents, fires, and other hazards resulting in lack of dependence when serious necessity for fire fighting arises.

On the Laboratory grounds there is a deep well, and it is proposed to locate a 100,000 gallon storage tank on a 100 foot tower on the northwest corner of the Government tract. It is proposed to provide 2-inch water mains from this well to the tank and by means of a float controlled automatic motor pump outfit maintain a fixed water level in the elevated storage tank. An 8-inch water main will be installed and the existing 4-inch mains will be replaced with 8-inch mains so as to give adequate pressures. The system will also be interconnected with the Delta Branch Experiment Station fire system so that it can be used in case of emergency.

During the cotton ginning season numerous unavoidable fires result from the introduction of matches in the freshly harvested seed cottons through carelessness of the pickers, drivers, and trucks. Other common causes for gin fires is the presence of rocks, pieces of metal and other foreign substances in the cotton and also chokages or excessive friction which from time to time

is encountered in the gin stands where cotton wads up against the gin saws or sparks are stuck in the saws and ribs or over-head cleaners. The Laboratory has had an average of two minor fires per year since it was established. An additional hazard is imposed upon the Laboratories during the cotton ginning season by the necessary collection of a large variety of single variety seed cottons which must be gathered together when available and concentrated at the Laboratory site pending their ginning and return to the Federal and State experiment stations or cooperative parties from which they were obtained. As a consequence, there is usually on hand a quantity of cotton ranging in value from \$5,000 to \$20,000 which must be safeguarded as adequately as possible to protect both the grower and the Government. In connection with this storage of cotton the dangers of spontaneous combustion are always present because some of the moisture laden cottons tend to go into a natural heat.

The Delta Branch Experiment Station has had two serious fires recently. One occurred in November, 1936, with a fire loss estimated between \$75,000 and \$100,000. During this fire there was difficulty due to low water and defective power service. In February, 1939, a second disastrous fire occurred, causing a loss to the Mississippi Delta Branch Experiment Station of between \$50,000 and \$75,000. In this fire there was difficulty with water supply due to the low water. The heat from the fire was so intense that it cracked most of the windows on the north side of building No. 2 of the Cotton Ginning Laboratory. Both fires constituted a serious threat to all of the Cotton Ginning Laboratory buildings due to flying sparks and brands. Every possible precaution is taken to avoid fires at the Cotton Ginning Laboratory, which is amply supplied with hand extinguishers. However, if a reasonably complete protection is to be afforded, an adequate supply of water under suitable pressures is needed at the earliest practicable date.

(4) \$200 additional estimated for administrative promotions in accordance with the plan which is being uniformly applied in the Budget Estimates for 1941.

CHANGES IN LANGUAGE

Two changes are recommended in the language of this item. The first inserts a necessary semicolon after the word "agriculture", in the third line of this paragraph as it appears in the printed Agricultural Appropriation Act for 1940 (Pub. 159, 76th Congress), this punctuation mark having been inadvertently omitted in the first and subsequent prints of the 1940 Act.

The other change provides the necessary authorization for the construction of a garage and workshop at the Farm Tillage Machinery Laboratory, Auburn, Alabama, and for the construction of a water tower fire protection system at the U. S. Cotton Ginning Laboratory, Stoneville, Mississippi, for which \$10,000 and \$15,000, respectively, are included in the estimates for 1941.

WORK UNDER THIS APPROPRIATION

General.--The work under this appropriation consists chiefly of research on the engineering problems of agriculture. These problems are included in the fields of farm machinery; farm power; rural electrification;

farm buildings; cotton ginning; fiber flax processing; dust explosion and fire prevention; and the development of farm lands to make possible their most economical and effective utilization. On request, the Bureau also renders engineering service to other bureaus of the Department with respect to the facilities and equipment required in their work.

1. Advice and Assistance.--This item covers such informational activities as preparation of Farmers' Bulletins and leaflets; preparation and sending out of plans and drawings relating to farm structures; handling of subject-matter correspondence with the public; preparation of motion pictures; and such other activities as are involved in making available to the public for direct application information regarding the Bureau's work. The project does not include technical bulletins presenting results of research as such bulletins are charged against the particular research project involved.

2. Farm Mechanical Equipment.--The purpose of the work under this project is to bring about a more efficient use of farm power and machinery in order to reduce the farmers' cost of crop production and harvesting. In cooperation with federal, state and other agencies studies are conducted, (1) to develop equipment for more effective control of insect pests, weeds and plant diseases; (2) to improve fertilizer placement machinery and practices; (3) to develop and improve crop production machinery; and (4) to establish reliable data on the performance and cost of operating various farm machines. The work on insect pests and weed control is designed to improve existing machinery and to develop mechanical equipment necessary for better control of the corn borer, grasshopper, pea-weevil and aphid; to combat such noxious weeds as the bindweed, thistle and white top and such plant diseases as apple scab, cherry leaf spot, etc. Studies on fertilizer machinery include determination of the most advantageous placement of fertilizers with respect to the seed or plant so that the farmer will receive the greatest return for the money spent on this item. About 50 experiments involving the use of 20 fertilizer dispensing machines are now under way in 13 states.

The crop production machinery work includes studies with corn in which special attention is given to narrow row spacing, to drilling and cultivation methods, and to the field picker-husker to reduce field losses; with cotton, studies of seedbed preparation methods and equipment are emphasized, and development of mechanical pickers closely followed; with sugar beets mechanization of the operations such as blocking and thinning, and of harvesting involving a large amount of hand labor is being featured; and with sweet potatoes, problems on harvesting, dehydration and vine utilization for livestock feed are being given attention. Basic studies of tillage equipment are under way at the U. S. Farm Tillage Laboratory, Auburn, Alabama, where nine large plots each with a distinct soil type are available under controlled conditions. The results of these studies will effect improvement of tillage equipment for use in the major crop producing areas of this country. Work on utilization and cost of farm power and machinery deals with miscellaneous research problems such as performance studies of combines and studies of labor, power and machinery requirements for ensiling grass.

3. Farm Structures and Related Investigations.--The research in this project is directed to developing types of structures and related equipment better suited to the present and probable future requirements of the farm family, livestock and crops. Farmhouses are studied to find the effects of building layout and type of construction on temperature control, fuel economy, and general usefulness and to develop low-cost means of providing better living conditions. The project includes studies of heating equipment for farmhouses and other purposes, such as orchard heating. Investigations relating to buildings for cattle, hogs, sheep, poultry, and other livestock deal with temperature control, ventilation, selection of materials and construction. Studies of silos and of storages for potatoes, apples, corn and other crops aim to provide structures which will best preserve the quality of the products but be economical in cost and resist deterioration caused by such conditions as excessive weight or pressure, condensation due to moisture given off by the crop, action of corrosive juices or fumes, or fire hazard. Studies on transportation of farm products deal with temperature and other requirements of fruits and vegetables in transit, and improved means for meeting these requirements are being developed.

In addition to the research duties, this project is a principal center for information on farm housing and other farm building problems, serving the public through some 40 publications, a comprehensive building plan service, and direct replies to thousands of letters of inquiry. The project has for several years been cooperating with State agricultural colleges in the establishment of farm building plan services on a regional basis. Plan catalogs for three regions have been prepared, and arrangements made so that blueprints of the designs illustrated are sold at a few cents per sheet by the State colleges in the region.

In 1930 farm buildings in this country were valued at more than 13 billion dollars or 30 percent of the value of all farm real estate. Farm repairs were generally postponed during the depression and now there is a tremendous accumulated need for new buildings, repairs, and modernizing work on farms.

Research work conducted under this project assists the farmer to obtain the maximum value for money invested in new farm structures, and in farm building improvement.

4. Machinery for Processing Farm Products.--Work under this project is directed toward the development of machinery and equipment for the processing of farm products in order that returns to the farmer may be increased by improving and preserving the quality of the product, by developing new or increased uses, and by reductions in costs of harvesting and processing. The investigations in progress at the present time deal with the ginning of cotton and the handling and processing of fiber flax.

Studies on cotton ginning, conducted in cooperation with the Agricultural Marketing Service, are to improve the equipment and methods used in drying, cleaning, extracting and handling of cotton in order to produce a superior quality of lint with resulting increased returns to growers. Intensive research on cotton is justified by its importance in the livelihood of a large part of our population, since it is the principal cash crop

of the entire cotton-producing area. The crop is also of primary importance in domestic commerce and manufacture, the normal domestic consumption being approximately six million bales. Cotton is also the country's principal agricultural export product. In view of the aggressive competition from high-quality foreign production, the improving of the quality of ginned American cotton is of vital importance to the industry if our export market is to be maintained.

The work on fiber flax is concerned with the improvement of methods and machinery used in production, retting, and scutching operations in order to yield a high quality fiber, comparable to that produced abroad, and at the same time to reduce production and processing costs, which factors hinder the expansion of this industry. Some 3,000 to 5,000 acres of fiber flax are now grown annually in the Willamette Valley of Oregon and eventually this crop may be revived in certain areas in the East. With an expansion of this industry in the United States, the importations of fiber flax and linen, now valued at from 30 to 50 million dollars annually, would be greatly reduced.

5. Farm Operating Efficiency Investigations.--This project concerns the over-all improvement of farms with particular consideration to the engineering need in the improvement of land, fields, buildings, power, machinery and their organization. The object is to establish ways and means of conserving and utilizing all farm resources to reduce the costs of production, increase farm profits and establish better living conditions. Studies conducted cooperatively with State experiment stations on over 100 farms throughout the humid region from Minnesota to Georgia show that practically every farm is capable of improvement and the lack of adequate improvements in land, structures, equipment and organization is to a large degree responsible for the lack of profitability.

The investigations conducted on typical farms are designed to obtain useful data on the improvement of land, buildings, power and machinery for general application to the predominate types of farms within an agricultural region. The range of problems on 25 typical farms in one State follow: Three-fourths of the farms needed drainage improvements. Eighteen of the 25 farms had field obstructions of brush, stumps or stones that prevented economical tillage. Sixteen of the farms had land and water facilities for irrigation but only four farms were equipped for irrigation. Approximately 50 percent of the area on 24 of the 25 farms required changes in tillage practice and equipment to control erosion. Fields were too small and patchy for economic tillage. Each of the farms had a building problem to provide adequate protection for crops, livestock, equipment and the farm people. Principles and practices of improvement are developed by topographic and other surveys, analysis of farm resources and the formation of operating and development plans for typical farms. Results show each and every farm is capable of improvement in the use and conservation of land, labor, buildings, the elimination of waste, the reduction of costs, and increased profits of operation. (This project is being discontinued in 1941).

6. Rural Electrification Investigations.--This project has for its purpose the development of safe and economical uses of electricity on the farm. It consists of studies of farm processes and operations in relation to the use

of electrical appliances and electrically-driven equipment, analyzing the results, and developing new or adapting present equipment to farm operations, keeping in mind the fact that these applications must produce income to permit the expansion of rural electrification to low-income farms. The project includes investigation of the relations of electrical and associated phenomena (light, heat, magnetism and high-frequency wave energy) to development, activity, or destruction of plants and animals. The project planned includes also investigations of tractive and mobile power as well as stationary power.

Rural electrification has developed until now nearly 25 percent of the farms have electric service available at the farmstead, representing an investment of over \$1,100,000,000 or around \$750 per electrified farm. The purchase of hundreds of millions of dollars worth of electrical equipment, wiring, and electrical energy by farmers will bring benefits only in proportion to the ability of the farmers to utilize them economically or for improved living conditions. If the 75 percent of farms yet unelectrified are to have electricity, means of using it for income-producing purposes must be found. It is the aim of the work to discover ways of using it to this end.

7. Dust Explosion and Fire Prevention.---Work under this project includes studies of dust explosions and explosion hazards in grain-handling operations and in industrial plants handling products of agricultural origin; experimental chemical research and development work on the prevention of dust explosions and fires; and the practical application of the results of this research. Special attention is being given to the development of safety codes for dust explosion prevention. Active cooperation is carried on with farm organizations, agricultural experiment stations, industrial companies, insurance organizations, State commissions, fire prevention associations, safety organizations, and other interested agencies in the practical applications of the results of this research and in the preparation of protective measures. These investigations are directly concerned with saving human life and property, and the research work is directly associated with the development of safety measures in the more efficient utilization of agricultural products. Increased industrial operations and the utilization of byproducts and waste materials resulting in the production and accumulation of large quantities of explosive dusts have greatly increased the hazards. With practically every new development for the utilization of agricultural products, it is necessary to work out new methods for protection from dust explosions and fires.

SUPPLEMENTAL FUNDS

Projects	Obligated 1939	Estimated obligations, 1940	Estimated obligations 1941
<u>Public Works Administration Appropriation Act of 1938:</u>			
Construction of laboratory and comple- tion and repair of government dwell- ings and laboratory buildings at Stoneville, Miss.	\$15,097	---	---
<u>Emergency Relief Appropriation Act of 1938:</u>			
Works Progress Administration, Public Buildings, Parks, Utilities, Flood Con- trol, etc.			
Construction of laboratory and comple- tion and repair of government dwellings and laboratory buildings at Stoneville, Miss.	3,898	---	---
Works Progress Administration, Administrative Expenses:			
For administrative expenses in connec- tion with the construction of labora- tory and completion and repair of government dwellings and laboratory buildings at Stoneville, Miss.	199	---	---
For over-all engineering planning in connection with emergency relief projects	7,886	---	---
Total, Emergency Relief Appro- priation Act of 1938	11,983	---	---
Total, Supplemental Funds,	27,080	---	---

(e) NAVAL STORES INVESTIGATIONS

Appropriation Act, 1940.....	\$89,400
Budget Estimate, 1941.....	<u>96,600</u>
Increase.....	<u><u>7,200</u></u>

PROJECT STATEMENT

Projects	1939	1940 (Estimated)	1941 (Estimated)	Increases
Naval Stores Investigations:				
(a) Naval stores production, processes, and equipment...	\$39,411	\$39,906	\$39,906	---
(b) Composition, properties, components and derivatives of naval stores.....	20,978	26,241	26,241	---
(c) Uses, handling, and transportation of naval stores	18,027	23,253	23,253	---
(d) Repairs to naval stores station.....	---	---	7,000	+ \$7,000 (1)
(e) Additional for administrative promotions.....	---	---	200	+ 200 (2)
Unobligated balance.....	984	---	---	---
Total appropriation.....	79,400	89,400	96,600	+ 7,200

INCREASES

The increase of \$7,200 in this item for 1941 consists of:

(1) An increase of \$7,000 to provide material and labor to repaint the frame buildings at the Naval Stores Station, Olustee, Florida, in order to protect and preserve them, and to repair old roads and drains on the station grounds. These buildings have not been repainted since erection in 1931-32, excepting the fire still, which was painted in 1936. The present roads are of sand and clay and, due to heavy use, they are greatly in need of repair. The regular appropriation has not provided sufficient funds to permit having this work done.

(2) \$200 additional estimated for administrative promotions in accordance with the plan which is being uniformly applied in the Budget Estimates for 1941.

WORK UNDER THIS APPROPRIATION

The purpose of this work is to improve agricultural-chemical-technological practices, processes and equipment for the production of turpentine, rosin and related products, so as to prevent deterioration and waste, reduce costs of production, and obtain products of better quality; to carry on fundamental studies of the chemical composition and properties of pine

oleoresin, turpentine and rosin; to develop processes and equipment for improving established naval stores products, and to expand present and develop new uses for oleoresins, turpentine, and rosins, needed to absorb current production and the inevitable increase that will ultimately occur. The average annual value of naval stores is approximately \$40,000,000 with an annual average production of approximately 650,000 fifty-gallon casks of turpentine and 2,500,000 five-hundred pound barrels of rosin, with an assured potential production through voluntary regrowth of pine timber of a much larger volume. Naval stores are important day-to-day cash crops of the South, affording a living to more than 300,000 persons in an area 70 percent of which is devoted to the growth of forests and provides the major business of large areas in the South. Over 20,000 farmers produce and sell the crude turpentine gum and nearly 2,000 producers operate stills to separate the gum into turpentine and rosin. It is only by reducing costs of production and by increasing consumption through new uses of naval stores that this large number of people may be afforded a living. The rational use of land, through land-use adjustment is a major problem in Southern agriculture. These investigations on naval stores bring greater returns to the turpentine farmer and have a direct bearing on the economic maintenance of the pine forests of the South, thus also helping to keep submarginal lands out of other agricultural crops for which they are neither suited nor needed.

(f) FERTILIZER INVESTIGATIONS

This item, carried under the Bureau of Agricultural Chemistry and Engineering in 1940 at \$225,000, is transferred in the 1941 Estimates and set up as a subappropriation under "Salaries and Expenses, Bureau of Plant Industry."

SUPPLEMENTAL FUNDS
(Complete bureau statement)

Projects	Obligated, 1939	Estimated obligations, 1940	Estimated obligations, 1941
Transfers (2) from State Department --for investigations to determine damages to crops and forests in State of Washington by fumes from smelter at Trail, British Columbia.(see "Agricultural Chemical Investigations").....	\$12,324	\$9,444	---
Public Works Administration Appropriation Act of 1938: Construction of laboratory and completion and repair of Government dwellings and laboratory buildings at Stoneville, Miss.....	15,097	---	---
Emergency Relief Appropriation Act of 1938: Construction of laboratory and completion and repair of Government dwellings and laboratory buildings at Stoneville, Miss. 3,898		---	---
For administrative expenses in connection with physical improvements at Stoneville, Miss.	199	---	---
For over-all engineering planning in connection with emergency relief projects..	7,886	---	---
Total, Emergency Relief Appropriation Act of 1938.....	11,983	---	---
Special Research Fund, Department of Agriculture: For special research projects in the fields of chemistry and engineering.....	263,840	240,130	\$239,480
Conservation and Use of Agricultural Land Resources (New Uses and Markets for Farm Commodities, Regional Laboratories, and Surveys): For four regional research laboratories, to develop new uses and markets for farm commodities, authorized by Sec.302 of the Agricultural Adjustment Act of 1938 (includes survey in 1939).....	3,981,066	3,184,000	3,179,000
Total, Supplemental Funds.....	4,284,310	3,433,574	3,418,480

PASSENGER-CARRYING VEHICLES

The authorization for the purchase of passenger-carrying vehicles for the Bureau of Agricultural Chemistry and Engineering contemplates an increase of \$125 (\$3,725 in 1940, \$3,850 estimated for 1941) for this purpose. This \$3,850 will permit the needed replacement of three vehicles at a net average cost of \$600 when exchange allowances are taken into account and the purchase of three additional cars at an estimated cost of \$683 each. Of the three additional cars, two are required in connection with Agricultural Engineering field work and the other in connection with Agricultural Chemical Investigations.

Automobile transportation is indispensable for the proper conduct of the Bureau's work, since a great many of the points visited are in remote areas where public transportation facilities are very limited and in many cases not at all available. The Bureau has many experimental projects located on privately-owned farms, and it is sometimes necessary that employees go from farm to farm in checking up on these projects. Public conveyances are not available for such trips, but an automobile makes it possible to visit a number of farms in a day. The purchase and operation of Government-owned cars has been found from experience to be more economical than either the hiring of commercial automobiles or the use of personally-owned cars of employees on a mileage basis. Records kept over a series of years indicate that the average per-mile cost of a Government-owned car, figuring in the purchase price and all operating and maintenance expenses up to the time it is turned in as no longer serviceable and then deducting the exchange allowance, is less than three cents. On the other hand, the cost of hiring personally-owned vehicles of employees averages about five cents per mile and for hiring commercial cars from 10 to 15 cents per mile.

Before the end of the 1941 fiscal year the three cars to be replaced will all be four years old or more. These machines have been operated under practically all conditions of use, ranging from city streets to extremely rough country roads. Their average performance as of June 30, 1939, was approximately 40,000 miles, and it is estimated that their average mileage will be approximately 55,000 miles before they are actually turned in. In the experience of the Bureau cars will not operate efficiently or economically beyond this mileage, and it is in the best interests of the work to turn them in during the fiscal year 1941, as herein provided.

BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE

(a) GENERAL ADMINISTRATIVE EXPENSES

Appropriation Act, 1940.....	\$166,280
Budget Estimate, 1941.....	166,900
Increase.....	<u>620</u>

PROJECT STATEMENT

Projects	1939	1940 (Estimated)	1941 (Estimated)	Increase
General administration and business service.....	\$165,281	\$166,280	\$166,280	- - -
Additional for administrative promotions.....	- -	- -	620	+\$620 (1)
Unobligated balance.....	999	- -	- -	- - -
Total appropriation.....	166,280	166,280	166,900	+ 620

INCREASE

(1) \$620 additional is estimated for administrative promotions in accordance with the plan which is being uniformly applied in the Budget Estimates for 1941.

WORK UNDER THIS APPROPRIATION

The funds provided under this appropriation are used for general administrative purposes, including the determination of policies, general administrative supervision of all departmental and field activities, business operations; approval and preparation for publication of manuscripts concerned with the scientific, technical, and other activities of the Bureau; preparation and distribution of general information on control of insect pests; maintenance of a comprehensive library of entomological literature and the preparation of bibliographies on entomological subjects; and the handling of general information relating to Federal quarantines and preparation of cases on quarantine violations.

SUPPLEMENTAL FUNDS

	Obligated, 1939	Estimated obligations, 1940
<u>Emergency Relief Appropriation Acts of 1938 and 1939:</u>		
For administration of emergency work relief projects set forth under the various headings in the following notes and summarized at the end hereof.....	\$275,000	\$198,138

(b) FRUIT INSECTS

Appropriation Act, 1940.....	\$428,600
Budget Estimate, 1941.....	416,124
Decrease.....	<u>12,476</u>

PROJECT STATEMENT

Projects	1939	1940 (Estimated)	1941 (Estimated)	Increase or decrease
Investigations on:				
1. Apple and pear insects.....	\$90,000	\$90,670	\$90,670	- -
2. Peach insects.....	51,885	52,869	52,869	- -
3. Grape insects.....	10,930	10,995	10,995	- -
4. Nut insects.....	26,070	26,500	14,584	-\$11,916(1)
5. Insects attacking dried fruits.....	15,640	16,002	16,002	- -
6. Citrus and other subtropical fruit insects.....	39,895	41,020	41,020	- -
7. Fruit flies which are poten- tial pests in continental United States.....	72,399	75,411	75,411	- -
8. The insecticidal value of oils.....	4,890	5,120	5,120	- -
9. Japanese and Asiatic beetles	109,340	110,013	106,013	- 4,000(2)
Additional for administrative promotions.....	- -	- -	3,440	+ 3,440(3)
Unobligated balance.....	7,551	- -	- -	- -
Total appropriation.....	428,600	428,600	416,124	- 12,476

INCREASE OR DECREASE

The reduction of \$12,476 in this item for 1941 consists of:

(1) A decrease of 11,916 for investigations on nut insects, involving discontinuance of the work on pecan insects, except the activities conducted at the Monticello (Florida) station on pecan case bearers and certain miscellaneous pecan insects. The stations at Albany, Georgia, and Brownwood, Texas, will be discontinued. Activities to be discontinued are:

"Investigations on hickory shuck worm on pecan" \$6,800

"Investigations on natural enemies of pecan insects" \$2,500

"Investigations on black pecan aphid" \$200

"Investigations on obscure scale and phylloxera on pecan" \$200

A reduction of \$2,216 will be made in the allotment for "Investigations on miscellaneous pecan insects".

(2) A decrease of \$4,000 for investigations on Japanese and Asiatic beetles, involving curtailment of work being done at Moorestown, New Jersey, in the colonization of imported parasites of the Japanese beetle.

(3) \$3,440 additional estimated for administrative promotions in accordance with the plan which is being uniformly applied in the Budget Estimates for 1941.

WORK UNDER THIS APPROPRIATION

General.--This appropriation provides for investigations on insects affecting fruits, fruit trees, nuts, grapes, and those small fruits which have their seeds internally, such as blueberries and cranberries and the development of measures for their control. These also include investigations on the Japanese and Asiatic beetles and fruit flies--such as the Mediterranean fruit fly and the Mexican fruit fly. The studies on insects other than fruit flies native to other countries are directed by the Division of Fruit Insects Investigations which is headquartered in Washington. Field laboratories at which investigations are carried on and where growers may obtain information as to control of pests are maintained in the principal fruitgrowing regions of the country. The investigations on fruit flies native to other countries are directed by the Division of Fruit Fly Investigations with headquarters in Mexico City, Mexico. Field laboratories for these studies are maintained in Mexico, Hawaii, Puerto Rico, and in the Canal Zone.

The work conducted under this item is divided into nine financial projects which are briefly discussed in the following paragraphs:

1. Investigations on apple and pear insects.-- The funds provided under this project are used almost exclusively for investigations to develop effective and economical means of controlling numerous pests of apples. The standard control for the codling moth leaves harmful insecticidal residues on the harvested fruit and presents such a critical situation and such a difficult problem that funds under this project have, during the past year, been devoted very largely to investigations on the codling moth. The use of the standard insecticide, arsenate of lead, for the control of the codling moth, leaves residues of lead and arsenic which may be injurious to human health. This condition is corrected in part by washing the fruit in dilute hydrochloric acid or other solvents to remove excessive residue, but this operation is costly and cannot be economically applied throughout the entire country. Effective substitutes for the method of control now recommended are needed at as early a date as practical. The investigations now under way include laboratory and field tests on new insecticides, (one of which, a nicotine-bentonite mixture, shows very encouraging possibilities), control by traps and baits, and the use of cultural practices and natural enemies.

To assure that the procedures developed for the control of the codling moth will not be in conflict with those used for other pests of apple and pear, a small part of the funds under this project are used for incidental investigations on other insect pests such as the apple maggot, red spiders, and tarnished plant bug. A small amount is also used for studies on the pear thrips in the Pacific Northwest. These studies are carried on in cooperation with the Oregon Agricultural Experiment Station.

2. Peach Insect investigations.-- Funds allotted to this project are used for investigations on the various insects attacking peaches, such as the Oriental fruit moth, plum curculio, San Jose scale, and the peach tree borer, and for investigations to determine the relation of insects to peach diseases, particularly phony peach and peach mosaic.

In the absence of effective insecticidal control for the Oriental fruit moth, emphasis is being placed on the control of this pest by its natural enemies. Certain native parasites have proved to be effective in certain eastern areas, and these are being colonized in areas recently infested by the moth. In addition to the colonization of native parasites, a number of parasites imported from the Orient have been propagated in the laboratory at Morrestown, N. J. and liberated in infested peach orchards in various parts of the country. In some sections the parasites, especially those of domestic origin, have become sufficiently well established to bring about very appreciable control. Attention is now being given to the possibilities in mass rearing of the more effective parasites, in order to increase to a maximum the control obtainable by the use of parasites. This, together with a further extension of the distribution of promising parasites to recently infested areas, should be of material benefit to the peach areas in which the Oriental fruit moth is present, throughout the eastern United States east of the Rockies.

Investigations on the plum curculio are being carried on at the laboratory at Fort Valley, Georgia. Special attention is being directed toward the development of measures for control that will not require the use of lead arsenate throughout the season. The peach tree is very sensitive to arsenic, and severe foliage and bud wood injury sometimes occur with present spray programs, which also may, under some conditions, involve objectionable spray residues in the southern areas, where two broods of the curculio occur. Studies on the peach borer have been under way for some time in Georgia, with supplementary experiments in southern Illinois and western New York. A recently developed material for peach borer control - an emulsion of ethylene dichloride - seems to be a distinct advance over previous standard methods.

Certain diseases of the peach, particularly phony peach and peach mosaic, are believed to be transmitted by insects, and a determination of the insects responsible is essential to the success of the Department's program for eradication, as well as to efforts at local control. Intensive studies to determine the insects that may have a part in the spread of these diseases are under way. These include surveys of insect conditions in peach orchard areas, and investigations on disease transmission, which are carried on at laboratories in Tennessee, Texas, and California.

3. Grape insect investigations.-- The major problem being studied under this project is the development of effective means of controlling the grape berry moth without causing objectionable spray residues. Studies are under way to determine the practicability of modifying cultural practices so as to keep down heavy infestations, thus reducing the number of spray applications necessary. Investigations on insecticides other than those which

leave objectionable spray residues are also under way. Many of those tested remove the "bloom" of the grape desired especially for table varieties. The impracticability of washing grapes increases the difficulty of solving this problem. Changes in materials or spray programs for berry moth control may also affect the control of certain other pests, such as the grape rootworm, rose chafer, and the grape leaf folder, which have heretofore been held under control by the arsenicals used for the grape berry moth.

4. Investigations on nut insects.-- This project provides for investigations on insects attacking nuts, and the development of methods for their control. The investigations are directed only to those which affect pecan and those which affect filberts. For the fiscal year 1941 the studies on insects affecting pecan will be conducted from the field laboratory at Monticello, Florida, which is cooperative with the State Experiment Station, special attention being given to the nut casebearer. Comparatively little is known about the insect pests of filberts. Investigations on them are headquartered at a laboratory at Eugene, Oregon, where special attention is being given to the Catilina cherry moth, which appears to be the most important among the insects attacking the filbert.

5. Dried fruit insect investigations.-- The work under this project is concerned with insects attacking dried fruits and the determination of methods for their control. Many of the insect pests found in dried fruit occur in and infest the fruit in the orchard and vineyard as well as when it is being dried and stored. These activities are largely centered in the laboratory at Fresno, Calif., and many of them are carried on in cooperation with the University of California and The Dried Fruit Association of California.

6. Investigations on citrus and other subtropical fruit insects.-- This project is concerned with investigations on insects attacking citrus and other subtropical fruits and the development of measures for their control. These studies are carried on at field laboratories in Florida and California. In California particular attention is devoted to the development of effective methods of controlling the California red scale and citrus thrips. Methods for control of the red scale previously worked out have been found to be ineffective in certain sections where the insect seems to be resistant to the standard methods of control by fumigation, and despite the development of improved methods, there remains need for further work in this field. In this same general section the use of sulphur dust for the control of thrips is not entirely satisfactory, especially on lemons, because of the need for applications through the hotter months of the year, when sulphur sometimes causes injury. Further work is needed with methods and timing of application, as well as with materials other than sulphur. Work in California is carried on in cooperation with the California Citrus Experiment Station and coordinated with that done by other agencies.

In Florida special studies are being conducted in cooperation with the Bureau of Plant Industry on the effect of certain insecticides, particularly sulphur materials and oil sprays, on citrus trees and fruits. The use of sulphur for the control of rust mites and certain scale insects is also being studied in Florida. Special emphasis is being placed on the timing of applications, and the development of adhesives or other accessory materials to prolong the period of effectiveness of sulphur sprays. The influence of heavy deposits of certain sprays in stimulating increase of whiteflies and scale

7. Investigations on fruit flies which are potential pests in continental United States.-- This project is concerned with investigations on the biology and methods of controlling certain important fruit flies in their native regions in order to provide information which will aid in preventing them from entering the United States and the development of methods for their control if they should become established in the United States. The investigations are headquartered in Mexico City, Mexico; Honolulu, T. H.; Balboa, Canal Zone; and Mayaguez, Puerto Rico. In Mexico City, which has general direction of the entire project, special attention is directed to the Mexican fruit fly and certain related species. Particular attention is now being given to developing attractants that can be used in traps to detect the presence of the fly, sprays to aid in its control, and methods of treating fruit to make it safe for shipment. Such information is particularly needed in connection with the work in the Lower Rio Grande Valley in Texas. Work is also being done on the relation of climatic factors to the insect. The work in Hawaii is concerned with the Mediterranean fruit fly and the melon fly. Special attention is now being directed to the development of sprays to be used in controlling the adults, development of attractants that may be used in traps, determination of more effective methods for the disposal of waste or culled fruit, and methods for treating fruit to permit it to move safely in trade. Attention is also being given to fumigation studies. The work in the Canal Zone is concerned with studies on the life history, habits, and hosts of numerous species of fruit flies which occur there and which are a menace to the fruit cultures of the United States. In Puerto Rico experiments are under way to determine more effective methods of combating the two kinds of fruit flies which occur there and previously referred to as the West Indian fruit fly, particular attention being directed to methods of treating fruit to kill any living forms it may contain.

8. Investigations on the Insecticidal Value of Oils.-- This project provides for investigations to develop oil sprays for the control of insect pests on fruit trees. Basic information is needed to determine the kinds of oils that may be safely used for this purpose. Attention is now directed to the use of oil sprays to which other toxic substances have been added to kill citrus red scale and the use of such materials to supplement fumigants now used to combat this pest. These studies are conducted at the laboratory at Whittier, California.

9. Investigations on Japanese and Asiatic Beetles.-- This project provides for investigations to determine methods of control for three introduced pests of major importance--the Japanese beetle, Asiatic garden beetle, and Oriental beetle. The work under way is concerned with the development of more effective methods of control of these pests by the use of insecticides and by other artificial means, the introduction and colonization of parasites which may aid in reducing their numbers, and the determination of methods of treating plants or plant products which may carry this pest into uninfested regions. These investigations include work on the adults and larvae, as these beetles are injurious as grubs and adults. These activities are headquartered at the laboratory at Moorestown, New Jersey.

SUPPLEMENTAL FUNDS

Project	Obligated, 1939
<u>Agricultural Adjustment Administration</u> (Payments for Agricultural Adjustment)(in lieu of sugar tax funds):	
Fruit fly control in Hawaii.....	\$737

(c) JAPANESE BEETLE CONTROL

Appropriation Act, 1940.....	\$395,000
Budget Estimate, 1941.....	397,840
Increase.....	<u>2,840</u>

PROJECT STATEMENT

Projects	1939	1940 (Estimated)	1941 (Estimated)	Increase
1. Japanese beetle control operations:				
(a) Supervision of nurseries and greenhouses for Japanese beetle control.....	\$162,764	\$165,000	\$165,000	- -
(b) Scouting adjacent to nurseries and greenhouses for Japanese beetle control...	29,589	30,000	30,000	- -
(c) Trapping to determine distribution of the Japanese beetle.....	87,637	70,800	70,800	- -
(d) Soil treatment and trapping in isolated areas to aid in preventing spread of the Japanese beetle.....	9,000	29,200	29,200	- -
(e) Farm products inspection for Japanese beetle control...	35,922	30,500	30,500	- -
(f) Vehicular inspection for Japanese beetle control.....	50,537	51,000	51,000	- -
(g) Transit inspection for Japanese beetle control.....	6,979	7,000	7,000	- -
(h) Tests of treatment required for Japanese beetle control...	11,466	11,500	11,500	- -
Additional for administrative promotions.....	- -	- -	2,840	+\$2,840(1)
Unobligated balance.....	1,106	- -	- -	- -
Total appropriation.....	395,000	395,000	397,840	+ 2,840

INCREASE

(1) \$2,840 additional is estimated for administrative promotions in accordance with the plan which is being uniformly applied in the Budget Estimates for 1941.

WORK UNDER THIS APPROPRIATION

This appropriation provides for operations to prevent spread of the Japanese beetle, including inspections to determine spread, the enforcement of quarantine regulations to prevent and retard spread into new localities, and inspection and certification of nursery stock and other materials, the movement of which is regulated under Federal and State quarantines. It also provides for operations carried on in cooperation with the state and local agencies to suppress the beetle (1) in localities considerable distances from the generally infested area to prevent the development of new centers of spread, and (2) in areas within infested sections where the state and local agencies actively engage in an effort to control the beetle and thus retard the build-up of heavy infestations in other parts of the state. The work involves a number of activities which are briefly described as follows:

The Japanese beetle occurs in the largest nursery sections of the United States. Nursery products produced in the infested area are shipped to every state in the United States. To prevent them from carrying the beetle to uninfested sections all those moving from the quarantined area must be handled or treated in a manner to eliminate risk of spreading of infestation. Products produced or handled as required by quarantine regulations and after prescribed inspection are certified and may move freely and without risk of carrying the pest into new sections. The requirements provided as a basis of certification vary with the class of nursery stock and the degree of infestation in or adjacent to the nursery or greenhouse in which it is produced. The adequate enforcement of these requirements forms the sole protection against the distribution of the Japanese beetle by these materials. Nursery stock is one agent by which the beetle may easily be transported into new sections. It is believed that this pest entered the United States in soil around the roots of nursery stock. If our uninfested regions are to be protected from infestation, it is important that adequate provision be made for inspection and certification of all such material moving to points outside of the quarantined area. There are more than 6,500 nurseries and greenhouses in the regulated area. Of this total, approximately 4,400 establishments are regular shippers of plant material to non-regulated areas, and over 1,900 nurseries and greenhouses maintain a classified status under the regulations. Millions of plants are certified for shipment annually.

Nurseries and greenhouses in the quarantined area are classified on the basis of presence or absence of beetle on or adjacent to the individual premises. The requirements for certification of material from the two classes of establishments differ. A very essential part of the enforcement of quarantines for the protection of uninfested regions is the classification of these establishments, which can be determined only by scouting rather than by the use of traps. Inspection work of this type must be done with great care to avoid erroneous classification of establishments so as to not work undue hardship on the producer and at the same time give adequate safeguards against products that may move from their establishments.

It is essential to the effort to retard the spread of the Japanese beetle that we have accurate information as to the possible presence of outlying infestations. To secure this information traps are operated to determine the possible presence and relative abundance of the beetle. The traps are operated in selected localities where infestation is light and at places outside the known infested area, particularly along main highways or at important transportation centers. The prompt location of incipient outlying infestations can be accomplished only by this type of work, and any curtailment will, as in the case of St. Louis, Missouri, delay locations of centers of infestation for a number of seasons. Trapping operations begin in the southern states early in June and at later dates in the more northern sections.

Under certain conditions of infestation and particularly in isolated centers of infestation the operation of a large number of traps aids in the reduction of beetles. Control operations of this type are carried on at St. Louis, Missouri, Detroit, Michigan, and Chicago, Illinois. In outlying areas where it is practical to locate sections where there is good reason to believe grubs occur in the soil, the application of certain treatments, such as arsenate of lead, will materially aid in reducing the number of beetles that appear next season. Work of this type is carried on in cooperation with the state or local agencies.

Many types of farm products, particularly fruits and vegetables, may carry adults of the Japanese beetle into uninfested regions. Beans, apples, peaches, and berries are produced in considerable quantities in the infested area and are products which must be handled under proper safeguard before they are shipped into the uninfested regions. The type of handling required prior to certification of various classes of products varies with the nature of the product. Various types of berries are fumigated and peaches are inspected, while beans are run through a mechanical device to shake off the beetles.

Refrigerator carloads of potatoes and onions from heavily infested sections are fumigated with methyl bromide. Provision is also made that products inspected and certified be subsequently handled in a manner to prevent reinfestation. Products of this type are perishable and the force of inspectors must be adequate to supervise the required treatment or inspect them promptly and effectively, so they can move in as nearly a normal manner as possible and still eliminate the risk of spreading the beetle.

To assure that products likely to carry the beetle are being moved only in accordance with the requirements of the quarantine, road stations are maintained on various highways leading from the quarantined area.

Inspectors are stationed at certain important transportation centers within the infested area during part of the season to examine products regulated by the quarantine in order to assure that common carriers comply with the regulations of the Japanese beetle quarantine regarding the movement of products that may carry this pest.

It is necessary to know that the methods of treatment devised under certain limited conditions are effective when applied commercially under different conditions. To determine the fitness or inadequacy of various treatments authorized as a basis of certifying products regulated under quarantine, it is necessary to make repeated tests. Without this repeated checking, possible weaknesses under prevailing conditions might not be detected and thus shipment of living beetles in certified articles might be unknowingly permitted.

(d) SWEETPOTATO WEEVIL CONTROL

Appropriation Act, 1940.....	\$75,000
Budget Estimate, 1941.....	70,400
Decrease.....	<u>4,600</u>

PROJECT STATEMENT

Projects	1939	1940 (Estimated)	1941 (Estimated)	Increase or decrease
Sweetpotato weevil control.....	\$67,579	\$75,000	\$70,000	-\$5,000 (1)
Additional for administrative promotions.....	- -	- -	400	+ 400 (2)
Unobligated balance.....	7,421	- -	- -	- -
Total appropriation.....	75,000	75,000	70,400	- 4,600

INCREASE OR DECREASE

The net decrease of \$4,600 in this item for 1941 consists of:

(1) A decrease of \$5,000 made possible by a reduction in the number of employees assigned to scouting and clean-up operations for sweetpotato weevil control.

(2) \$400 additional estimated for administrative promotions in accordance with the plan which is being uniformly applied in the Budget Estimates for 1941.

WORK UNDER THIS APPROPRIATION

This appropriation provides cooperation with states in the control and eradication of the sweetpotato weevil. Sweetpotato weevil is an introduced insect which is a limiting factor in the production of sweetpotatoes in the area where the pest occurs. The grub feeds within the vines and tuber of sweetpotato. It so injures the tuber that it is of little or no value for commercial purposes. The presence of grubs within the vine may cause the destruction of the plant or retardation of its growth. Besides feeding on sweetpotatoes the weevil also feeds on a variety of plants related to the sweetpotato such as wild morning glories. In localities where such wild hosts persist in a growing stage throughout the year, eradication of the weevil is not practical; however, production of sweetpotatoes is of no commercial importance in these sections. The work is conducted in cooperation with states and includes intensive inspections to locate infestations in the commercial sweetpotato producing areas, enforcement of quarantine measures to prevent the spread of the pest to uninfested areas and reinfestation of localities from which the pest has been eradicated, application of eradication measures such as the destruction of host plants, clean-up operations in fields, storages, and the use of sweetpotato seed free from weevil

infestation and development of methods for fumigating or treating sweet-potatoes to eliminate reinfestation by this means. An important feature consists of educational and demonstrational activities to advise growers on methods of combating the pest, particularly as to the methods which will enable them to carry out work they should do on their own properties.

The activities concerned are divided into four work projects which are briefly discussed in the following paragraphs.

Inspections to determine extent of infestation are carried on during the summer months in sweetpotato seed beds and where the volunteer plants were growing in fields in which potatoes were planted the previous year. In the fall, the inspections are concentrated in areas where potatoes are held in storage plants. Inspections in the spring are made largely in areas where sweetpotatoes are produced for bedding purposes.

In localities where infestations have been located in the commercial sweetpotato producing area, effort is made to eradicate these infestations by the adoption of sanitary practices, including the clean-up of crop remnants, destruction of seed beds after the plants have been removed, clean-up in and around storage beds, houses and similar places where sweetpotatoes are stored. These activities are carried on under state authority, and inspectors, state and Federal, supervise and direct the operations. Labor required in carrying out the work is provided by local agencies including growers in the area where the work is done.

At the Sunset, La., laboratory, studies are being conducted on fumigant or other treatments that can be used to eliminate infestation in tubers stored for home consumption or commercial use in areas where infestation occurs. Tests are made with various fumigants to determine the dosage, time, and temperature requirements to kill the weevils in different stages of maturity without injuring the sweetpotatoes for the purpose for which they are intended. Some of these have shown promising results, but further work is needed to determine those which will be most effective against the weevil and least harmful to the potato.

Cooperating states have promulgated necessary quarantines and regulator orders to prevent the spread of the weevil into noninfested areas and to prevent the reinfestation of localities in which the weevil is being controlled or has been eradicated. The individuals employed under this appropriation are designated by authorized state agencies to act as state inspectors in the enforcement of regulatory measures and cooperate with state inspectors in such work.

(c) MEXICAN FRUIT FLY CONTROL

Appropriation Act, 1940.....	\$160,460
Budget Estimate, 1941.....	176,135
Increase.....	<u>15,675</u>

PROJECT STATEMENT

Projects	1939	1940 (Estimated)	1941 (Estimated)	Increases
1. Mexican fruit fly control operations:				
(a) Grove and packing-house inspection and certification for Mexican fruit-fly control.....	\$130,080	\$128,660	\$133,660	+\$5,000(1)
(b) Spraying and control of Mexican fruit fly in Texas.....	20,187	21,800	28,300	+ 6,500(2)
(c) Spraying and control of Mexican fruit fly in Mexico.....	4,443	5,200	5,200	---
(d) Vehicular inspection for Mexican fruit-fly control.....	3,689	4,800	8,300	+ 3,500(3)
Additional for administrative promotions.....	---	---	675	+ 675(4)
Unobligated balance.....	2,061	---	---	---
Total appropriation.....	160,460	160,460	176,135	+15,675

INCREASES

The increase of \$15,675 in this item for 1941 consists of:

(1) An increase of \$5,000 for "Grove and packing-house inspection and certification for Mexican fruit fly control".--The heavy infestation of Mexican fruit fly in the Rio Grande Valley in Texas has necessitated the addition of Webb, La Salle, and Dimmit Counties to the quarantined area. The proposed increase is necessary in order to provide inspection service for this new area and also additional inspectors to meet the conditions of heavier infestation in the area previously under quarantine. This increase is absolutely essential in order to guard, through inspection in citrus groves and packing houses, against the spread of the Mexican fruit fly to areas now uninfested. It will provide for the services of a plant quarantine inspector and seasonal help, together with their travel and operating expenses.

(2) An increase of \$6,500 for "Spraying and control of Mexican fruit fly in Texas".--This increase is necessary to provide the services of temporary inspectors to supervise the heat sterilization of citrus fruit during the shipping season. Extensive experiments have demonstrated the value of heat sterilization, which has proved so rapid, economical, and effective that its general adoption in packing houses has been decided upon. At the end of the 1938-39 shipping season there were 45 sterilization rooms in operation. During the past season when infestation began to appear rather generally in the groves there were several thousand cars of fruit remaining on the trees. The only way this fruit could be certified for movement was on the basis of sterilization. This experience was so impressive that additional sterilizing equipment is being ordered or installed and observation and conferences with packing house operators indicate that at least 70 rooms will be in operation during the next shipping season. The present volume of work has been handled only at a cost of temporarily curtailing other important work and requiring of inspectors long hours of overtime. It is impossible to operate satisfactorily and efficiently on this basis, and the increase proposed is necessary to meet the situation.

(3) An increase of \$3,500 in the allotment for "Vehicular inspection for Mexican fruit fly control".--This increase is necessary in order to provide for the establishment and operation of a road station in the vicinity of Raymondville, Texas, in order to inspect citrus fruit moving out of the infested area on a new coastal highway which is now under construction and will be open to traffic by the fiscal year 1941. The operation of this station is absolutely necessary to prevent the spread of the Mexican fruit fly through shipments of citrus moving by truck. It will be manned during the shipping season by three temporary inspectors. The proposed increase will provide their salaries and a small amount for supplies and materials.

(4) \$675 additional estimated for administrative promotions in accordance with the plan which is being uniformly applied in the Budget Estimates for 1941.

WORK UNDER THIS APPROPRIATION

This appropriation provides for control and regulatory operation directed against the Mexican fruit fly to protect the fruit growing areas in the United States from danger of infestation by this insect which is known to attack many different kinds of fruits. These include the enforcement of the domestic quarantine on account of this pest, the supervision of control operations in the quarantined area in the Lower Rio Grande Valley of Texas, and cooperation with the Mexican government and local Mexican authorities to suppress the infestation of this pest as much as possible in areas in Mexico adjacent to the regulated area of Texas to reduce danger of reinfestation from that source. The work involves a number of different activities which are briefly discussed in the following paragraphs:

The Federal domestic quarantine on account of the Mexican fruit fly requires that the growers, packing plants and shippers comply with certain practices before fruit will be certified for moving to points outside of the regulated area. The compliance with these practices reduces or elimi-

nates the opportunity of spread of the pest through the movement of fruit, thus giving protection to the uninfested sections. The certification of fruit moved from the area assures compliance with the quarantine requirements and permits the movement of fruit from regulated areas to markets throughout the United States. The quarantine provides for the maintenance during the summer of a non-host period when fruits which may be attacked by the fruit fly do not remain on the trees. It provides for removal and the destruction by approved practices of culls and dropped fruits, for the maintaining of sanitary requirements in packing houses and similar places where fruit is handled, for the disposal by approved practices of fruit from areas where infestation may be detected, and for the sterilization of fruit when this is required as a condition of movement. Sterilization has become a factor of immense importance and as a result of the satisfactory results secured during the last two seasons, forty-five sterilization rooms have been installed and are operated by the shippers at their own expense, and indications are that at least twenty-five more will be installed during the forthcoming harvest season. The operation of these rooms is closely supervised by the personnel of the Mexican Fruit Fly Project. Citrus is the only fruit commercially produced in the regulated area. There are more than 6,500,000 trees set out in grove formation that have already reached the bearing age. The inspection of these trees to locate possible presence of the fruit fly and inspections to see that the growers and packing houses are maintained to comply with the quarantine regulations require a large amount of labor.

Infestations of the Mexican Fruit Fly were found in the spring of 1939 outside of the regularly established regulated area in the Counties of Webb, La Salle and Dimmit, Texas, and as there is citrus produced in these Counties in commercial quantity, it will be necessary to include them in the quarantined area. The inclusion of this territory will necessitate the hiring of additional field inspectors and will somewhat increase the expenses for material, supplies, motor equipment, and travel allowances. To handle the work of inspection and certification of products in the regulated area more effectively the area is divided into fourteen districts.

To detect the possible presence of the fruit fly, traps are operated throughout the year. If adult flies are found a poison spray on which the adults feed may be applied in the groves so the adults will be killed prior to laying of eggs. To be fully effective the proper application of this spray is essential and the work must be closely supervised.

No commercial fruit is produced in Mexico adjacent to the Lower Rio Grande Valley in Texas where infestations of Mexican fruit fly have been found. The only fruit trees in adjacent Mexican territory are those in door-yards grown largely for shade or ornamental purposes. Considerable quantities of fruit, however, are shipped from the interior of Mexico into this area for local consumption. Much of this fruit is infested and is a source of infestation of the fruit produced on dooryard and ornamental trees. The presence of this fruit and infestation permits the development of adult flies which may fly across the Rio Grande and infest the fruit grown in the regulated area in Texas. To reduce this opportunity inspection and cleanup work are carried on in Matamoros and other Mexican towns adjacent to the regulated

area. These operations may involve the disposition of infested fruits and the application of a poison spray to dooryard and fruit trees. This work is carried on with the hearty cooperation of the Mexican officials and citizens residing in that area.

Two highways leave the area in Texas regulated on account of the Mexican fruit fly. Large quantities of fruit are moved over these highways by truck and similar vehicles. To assure that the fruit so moving has been certified as meeting the requirements of the quarantine, road stations are maintained at appropriate locations. As previously indicated, a new highway will soon be in operation which will carry a large amount of traffic as it will be the most direct route from the Lower Rio Grande Valley to Houston and points northeast.

(f) CITRUS-CANKER ERADICATION

Appropriation Act, 1940.....	\$13,485
Budget Estimate, 1941.....	13,905
Increase.....	<u>420</u>

PROJECT STATEMENT

Projects	1939	1940 (Estimated)	1941 (Estimated)	Increase
Citrus-canker eradication.....	\$13,437	\$13,485	\$13,485	---
Additional for administrative promotions.....	---	---	420	+\$420 (1)
Unobligated balance.....	48	---	---	---
Total appropriation.....	13,485	13,485	13,905	+ 420

INCREASE

(1) \$420 additional is estimated for administrative promotions in accordance with the plan which is being uniformly applied in the Budget Estimates for 1941.

WORK UNDER THIS APPROPRIATION

This appropriation provides for the eradication of the bacterial disease of citrus known as citrus canker. These activities are carried on in active cooperation with the responsible agencies of the States concerned and the growers in localities where the disease occurs. Through intensive inspection of nurseries and citrus groves an effort is made to locate and destroy all trees infected with this dreaded disease.

As a result of the vigorous campaign which has been carried on against citrus canker in the past, the disease has been practically eliminated from the important commercial citrus areas. However, some isolated infections

occur sporadically. The States that were infected are maintaining a close inspection of all citrus properties, and this should be continued. The infections have not been eliminated in Louisiana and Texas, although no infection is known to occur in commercial properties in these States. Infections have been found in noncommercial trees in individual properties in Texas and Louisiana.

The work of eradicating this disease has been intensified by allotments from Emergency Relief funds, and an effort is being made to eliminate the source of all infections. Intensive inspections have been made in Mississippi, Alabama, and west Florida which were previously infected but no infection has been discovered. The locating and destruction of diseased trees in jungle areas where citrus trees occur as voluntary or escape stands of no importance and the elimination of seedlings from areas where infected trees have been removed are important features of the present work. Plants of this type may harbor the disease and prevent the completion of the eradication effort. Because of the extreme infectiousness of this disease, scattered infections may also occur in dooryard plantings outside commercial districts. It is necessary to follow up the work done in infected commercial properties and reinspect areas in noncommercial sections, even where trees have been removed, to see that all the shoots or sprouts have been eliminated or are free from infection. The presence of outside centers of infection are a menace to citrus cultures, and continued inspection and eradication work are essential until the disease has been completely eliminated.

SUPPLEMENTAL FUNDS

Projects	Obligated, 1939	Estimated obligations, 1940
<u>Emergency Relief Appropriation Acts of 1938: Citrus-</u> canker eradication.....	\$97,481	\$59,651

(g) GYPSY AND BROWN-TAIL MOTH CONTROL

Appropriation Act, 1940.....	\$375,000
Budget Estimate, 1941.....	379,640
Increase.....	<u>4,640</u>

PROJECT STATEMENT

Projects	1939	1940 (Estimated)	1941 (Estimated)	Increase
1. Inspection and certification for gypsy and brown-tail moth control.....	\$98,282	\$99,282	\$99,282	---
2. Control operations for gypsy and brown-tail moth control...	274,642	275,718	275,718	---
Additional for administrative promotions.....	---	---	4,640	+\$4,640 (1)
Unobligated balance.....	2,076	---	---	---
Total appropriation.....	375,000	375,000	379,640	+ 4,640

INCREASE

(1) \$4,640 additional is estimated in this item for 1941 for administrative promotions in accordance with the plan which is being uniformly applied in the Budget Estimates for 1941.

WORK UNDER THIS APPROPRIATION

General.--This item provides for control work on the gypsy and brown-tail moths and for the inspection and certification of products to meet the requirements of the Federal quarantines for those insects. The work is divided into two projects as follows:

1. Inspection and Certification for Gypsy and Brown-tail Moth Control.--The work under this project deals with the inspection and certification of products originating in the quarantined area designated for shipment to points outside. The possibility of the distribution of the gypsy moth over long distances on shipments of products which might carry it is illustrated by records on such shipments. Infestations have actually been discovered on and removed from shipments destined to practically every State in the Union. This inspection and certification covers commodities which are grouped into nursery, quarry, forest, and evergreen products. The certification is based on inspection, and the commodities thus inspected and certified are eligible for interstate transportation. Industries located within the infested area which deal with articles likely to carry these insects are enabled under Federal certification to ship their products in the normal way. If there were no Federal quarantine, State quarantines (which are practically embargoes)

would be in effect in nearly every State; and interstate business in such articles would operate under a severe handicap in the face of such a system of State embargoes.

2. Control Operations for Gypsy and Brown-tail Moths.--The work under this project is concerned with the control and extermination of infestations of gypsy and brown-tail moths which are so located as to be susceptible to spread by natural means to points outside the infested area. This work is carried on in cooperation with State agencies which make material contributions. The activities are carried on in the area immediately outside the known infested section, referred to as the Barrier Zone, and at points beyond where infestation has been found.

The Barrier Zone is an area some twenty to thirty miles in width, extending from Long Island Sound on the south to the Dominion of Canada on the north. This strip of land extends over into New York State for its western boundary and into the New England States for its eastern boundary, the center of the zone being approximately the eastern New York boundary line. Spread of moths by natural means from the generally infested area in New England into and through the Barrier Zone is controlled by the application of extermination measures in this zone. This requires scouting to locate infestations and their treatment to eliminate colonies which may be found.

The spread of the gypsy and brown-tail moths has been confined for the most part to a comparatively limited area comprising the New England states. Relatively small infestations of the gypsy moth on Long Island, in the Bronx in New York City, and near the Hudson River have been reduced or eliminated, as well as a heavy infestation in New Jersey, although these areas are still subject to frequent and thorough inspection. A large infested area found in 1932 in northeastern Pennsylvania is being controlled and gradually reduced. The nature of the work in these outlying infestations is similar to that employed in the barrier zone consisting of scouting to locate infestations, followed by the application of intensive suppressive measures with the objective of complete extermination. Cooperation of the states concerned is an important factor in the progress which has been made in dealing with these infestations.

Large allotments have been made available from emergency funds for the control of the gypsy and brown-tail moths. The supervision of this work is provided by the organization employed under the regular appropriation. Without this supervision the activities under the emergency funds could not be carried out. The funds for 1941 will be used for the continuation of this program that has been carried on during the last few years and the estimate contemplates that emergency funds will continue to be available for this work.

SUPPLEMENTAL FUNDS

	Obligated, 1939	Estimated obligations, 1940
<u>Emergency Relief Appropriation Acts:</u>		
Control and prevention of spread of gypsy moth..	\$939,391	\$740,845

(h) DUTCH ELM DISEASE ERADICATION

Appropriation Act, 1940.....	\$500,000
Budget Estimate, 1941.....	501,500
Increase.....	<u>1,500</u>

PROJECT STATEMENT

Projects	1939	1940 (Estimated)	1941 (Estimated)	Increase
1. Dutch elm disease eradication:				
(a) Scouting to locate the Dutch elm disease.....	\$382,673	\$380,000	\$380,000	---
(b) Identification of disease in trees suspected to be infected with the Dutch elm disease.....	29,500	40,500	40,500	---
(c) Enforcement of quarantine on Dutch elm disease.....	5,000	5,000	5,000	---
(d) Coordination of State work on the Dutch elm disease.....	44,556	44,500	44,500	---
(e) Removal of diseased, dead, and dying trees...	14,500	10,000	10,000	---
(f) Investigations and surveys on virus disease of elms prevalent in the Ohio valley.....	---	20,000	20,000	---
Additional for administrative promotions.....	---	---	1,500	+ \$1,500(1)
Unobligated balance.....	2,260	---	---	---
Total appropriation....	478,489	500,000	501,500	+ 1,500

INCREASE

(1) \$1,500 additional is estimated under this item for administrative promotions in accordance with the plan which is being uniformly applied in the Budget Estimates for 1941.

CHANGE IN LANGUAGE

It is recommended in the estimates that the language of this paragraph be amended to provide that the 1941 appropriation be made available immediately on approval of the 1941 Agriculture Appropriation Act.

In the effort to eradicate the Dutch elm disease an adequate scouting program is essential. One of the times when the evident symptoms of the Dutch elm disease can be more readily recognized is shortly after the leaves appear in the spring. This period varies with localities and seasons. It usually does not occur before the latter part of May or the first part of June. Hence, to effectively carry on the scouting, it is important that this work be started as early in the season as conditions permit. Because of seasonal and other factors it is not, however, possible to accurately indicate what portion of the funds may be effectively expended for this purpose. It is also recognized that during the past few years the annual act providing appropriations has not been approved until practically the beginning of the fiscal year which it covers. In order that every advantage may be taken of such scouting that can be done during the last few weeks of the current fiscal year, it is believed desirable that authorization be provided for the use of funds that may be appropriated as soon as the annual appropriation act is approved. The inclusion of the phrase "to be immediately available" will permit this and enable the Bureau to increase the scouting if conditions permit.

WORK UNDER THIS APPROPRIATION

This appropriation provides for supervisory and administrative personnel and expenses for the eradication of the Dutch elm disease from the United States and for the enforcement of the domestic quarantine to prevent the spread of the disease into uninfected regions. This includes scouting to locate the presence of the disease, the identification of suspected samples, the coordination of work done by various agencies, especially the cooperating States, and other activities concerned with the eradication of this disease which threatens the destruction of elms in the United States. The work of eradicating the Dutch elm disease is also supported by allotments of funds from emergency relief appropriations.

The origin of the Dutch elm disease in the United States is traced rather definitely to elm burl logs imported for furniture manufacture. These logs were found to be infested with the insects which carry the disease and some were also infected with the disease. The logs were entered at a number of different ports and went to factories at several different points to be cut into veneer. Beetles that were carrying spores of the fungus may have escaped en route to the factories or in the vicinity of the ports through which they were imported. It is necessary to inspect the right-of-ways of railroads over which these logs were transported to locate the possible presence of trees which thus become infected.

An important feature of the effort to eradicate the Dutch elm disease is scouting to locate its presence. The external symptoms of the disease consist of the discoloration and wilting of the foliage. There are other diseases of the elm which also produce similar external symptoms. Definite determination whether a tree is infected with the Dutch elm disease is obtained by taking samples from suspected trees, which are then cultured to isolate and determine the causative organism. The largest center of infection occurs in the vicinity of New York Harbor comprising an area of approximately 70 miles wide in the States of Connecticut, New York, and New Jersey. In this area

it is necessary to make intensive and repeated inspections to locate the presence of infected trees.

The disease is carried from tree to tree by elm bark beetles. These insects are attracted to elms or to parts of elm trees in which there is newly dead or dying wood and there they lay their eggs and rear their young. The next brood of beetles, when they emerge, will go to the new growth on near-by elms to feed, and if the condition of the elm tree in question resulted from the presence of the causative organism of the Dutch elm disease, they injure the tissue of the tree in the act of feeding and through this wound the spores of the Dutch elm disease may readily find their way, thus causing the infection to enter a tree not previously infected. The fungus thus carried to the uninfected tree gets into the circulatory system and is carried downward into the main portion of the tree, causing the affected portion of the tree to become discolored and to wilt.

There are two broods of these insects in a season in the area where the disease occurs; consequently after symptoms of the disease are noted there is ample time to remove a given tree before it serves as a source of infection to other trees. This affords a basis for the eradication program which is similar to the methods used in the eradication of other serious tree diseases where symptoms of the disease become visible before spread occurs.

In the past there were not a sufficient number of trained scouts to carry on an adequate scouting program over a sufficiently large area to insure that the outside limits of the infected area were known. Relief labor does not occur or is scarce in sections where there are heavy elm tree populations. Furthermore relief labor is limited as to the area a given crew can cover which limits the mobility of a force composed of relief employees. At the beginning of this fiscal year, using the increased in the Dutch elm disease eradication item, a scouting program was carried on in areas beyond the previously known limits of infection and inspection was provided for those areas where relief labor was scarce or not available. It was one of the objectives of the season's work to determine as nearly as possible how far the disease had spread. Infected trees were found in areas not previously known to be infected in New York, Pennsylvania and Connecticut.

The application of suppressive measures throughout the area during the season of 1939 resulted in a marked decrease in the number of diseased trees found. Inasmuch as this decrease in the number of confirmed infected trees was accompanied by an increase in the amount and quality of the inspection, it is believed the results are significant. Because of a number of conditions there was a decided increase in the number of diseased trees found in 1938 as compared with 1937. However, where 18,152 infected trees were found in 1938, 10,741 (through November 25) infected trees were found in 1939. Reductions were noted in the infection which has persisted for some years in Indianapolis from 34 trees last year to 10 this year. Increase from 10 trees last year to 199 this year took place in Pennsylvania where the first infected trees were found in the season of 1938. In Cleveland, Ohio, where 23 diseased trees were found in 1935 none has been found since. One tree was found this year in Maryland.

The domestic quarantine placed on account of the Dutch elm disease remains in effect. It prohibits the movement from the regulated area of logs, lumber, nursery stock, etc., which may carry the disease into uninfected regions.

The States in which infection has been located are cooperating in the eradication of this disease. They contribute funds and means for this purpose and provide the authority for the removal of the infected or weakened trees and also carry out certain phases of the operation. An important part of the work carried on under the project is the coordination of the activities done by the various agencies, including States, to eradicate this disease.

The only way that the Dutch elm disease can be eradicated is by the removal and destruction of infected trees. The effort of eradication also includes the location and removal of dead and dying trees in which the beetles that carry the disease from tree to tree may breed. The work concerned with the removal of trees is carried on very largely by funds supplied by State or local agencies or by the use of emergency funds provided to combat the disease. Certain features of the work involved in the removal of diseased or dead and dying trees are a part of the work conducted under this project.

SUPPLEMENTAL FUNDS

	Obligated, 1939	Estimated obligations, 1940
<u>Emergency Relief Appropriation Acts:</u>		
Eradication of Dutch elm disease.....	\$2,901,507	\$1,965,085

(i) PHONY PEACH AND PEACH MOSAIC ERADICATION

Appropriation Act, 1940.....	\$89,800
Budget Estimate, 1941.....	91,520
Increase.....	<u>1,720</u>

PROJECT STATEMENT

Projects	1939	1940 (Estimated)	1941 (Estimated)	Increase
Eradication of phony peach and peach mosaic.....	\$89,387	\$89,800	\$89,800	---
Additional for administrative promotions.....	---	---	1,720	+\$1,720 (1)
Unobligated balance.....	413	---	---	---
Total appropriation.....	89,800	89,800	91,520	+ 1,720

INCREASE

(1) \$1,720 additional is estimated under this item for administrative promotions in accordance with the plan which is being uniformly applied in the Budget Estimates for 1941.

WORK UNDER THIS APPROPRIATION

This appropriation provides for the control and eradication of two important diseases of peach. One of these diseases is known as phony peach and is a serious infectious disease which makes peach orchards unprofitable by reducing both the size and quality of the crop. The other, peach mosaic, is a virus disease which in relation to the United States is of comparatively recent appearance. It injures the tree by causing it to become stunted and produce undersized fruit which is hard, irregular in shape and of reduced commercial value. The only method of combating these diseases is to remove and destroy the tree. These operations are carried on in cooperation with state agencies. The appropriation also provides for cooperation with state authorities in the certification of products of the infested areas to meet the requirements of state quarantines.

The accurate determination of trees infected with phony peach disease or with the peach mosaic disease required special training. One of the important phases of eradication work carried on under this item in cooperation with the states includes inspections to locate diseased trees. These operations are conducted by trained inspectors employed under this project. The removal of diseased trees is carried on under the authority of the cooperating states, and with funds or means supplied by them or from emergency funds allotted to the Bureau for this purpose. To prevent long distance spread through the shipment of nursery stock containing diseased trees, intensive inspections are made in and around nurseries that produce peach nursery stock. The shipment of nursery stock from areas in which the disease occurs is prohibited by state quarantines

unless it is produced under specified sanitation conditions. Inspectors employed under this item cooperate with the state agents by giving them assistance which will aid them in certifying products in compliance with state quarantines. The Bureau has been instrumental in bringing about standardized phony peach disease quarantines in all the affected states.

The phony peach disease has been found in the States of Alabama, Florida, Georgia, Arkansas, Illinois, Oklahoma, Louisiana, Mississippi, Missouri, North Carolina, South Carolina, Tennessee, and Texas. A few infected trees have also been located in Maryland, Indiana, Kentucky, and Pennsylvania, although as a result of intensive inspection and eradication work, the disease has apparently been eliminated from such states, as well as from rather extensive areas in the remaining infected states. The infection in most of the states is scattering with the exception of that which occurs in the main peach producing areas of Georgia, Alabama, Tennessee and South Carolina. The disease was first located in the State of Georgia. The peach mosaic disease has been found in Colorado, Utah, California, New Mexico, Arizona, Texas, and Oklahoma.

Additional funds for relief purposes have been allotted to the Bureau to carry on work against both of these diseases. The continuation of such allotments is vitally necessary to any large-scale program of eradication, as the regular funds are sufficient only for technical and supervisory features. The work conducted with emergency funds has made it possible to make very substantial progress in the elimination of diseased trees. On certain areas, particularly sections where the phony peach occurs, large numbers of abandoned trees and seedlings which may harbor the disease have also been destroyed.

SUPPLEMENTAL FUNDS

Projects	Obligated, 1939	Estimated obligations, 1940
<u>Emergency Relief Appropriation Acts</u>		
Control of phony peach disease.....	\$278,144	\$189,155
Control of peach mosaic disease.....	129,975	125,749
Total.....	408,119	314,904

(j) FOREST INSECTS

Appropriation Act, 1940.....	\$253,100
Budget Estimate, 1941.....	255,540
Increase.....	<u>2,440</u>

PROJECT STATEMENT

Projects	1939	1940 (Estimated)	1941 (Estimated)	Increase or decrease
Investigations on forest insects:				
(a) Bark beetles attacking forest and shade trees.....	\$48,000	\$42,000	\$42,000	---
(b) Insects which feed on foliage of forest and shade trees.....	20,000	31,500	31,500	---
(c) Insects which bore through the wood and bark of forest and shade trees.....	6,000	8,000	8,000	---
(d) Sucking insects which attack forest and shade trees.....	5,000	7,000	7,000	---
(e) Insects attacking forest trees in nurseries, plantations, and areas of natural reproduction.....	3,400	5,500	5,500	---
(f) The relation of climatic factors, such as heat, cold, moisture, etc., on forest insect populations.....	3,200	4,500	4,500	---
(g) Insecticides for the control of insects attacking forest and shade trees.....	7,000	6,000	6,000	---
(h) Injection of chemicals into the sapstream of the tree for the control of bark beetle infestations and for the treatment of green trees to prevent insect attack upon the utilized wood.....	5,000	3,200	3,200	---
(i) Insects affecting forest products.....	6,000	12,500	12,500	---
(j) Habits and development of methods for control of termites	11,400	12,700	12,700	---
(k) Value and use of introduced and native parasitic and predacious enemies upon introduced and native forest insects	8,000	5,500	5,500	---
(l) Importation of natural enemies of forest and shade tree insects.....	2,500	1,800	1,800	---

Projects	1939	1940 (Estimated)	1941 (Estimated)	Increase or decrease
Investigations on forest insects - Continued:				
(m) Surveys to locate and deter- mine the status of insect pests of the forests and the giving of advice to land- managing agencies on planning and conducting necessary con- trol work.....	\$72,401	\$60,500	\$60,500	---
(n) Relation of insects to the Dutch elm disease.....	24,400	24,000	24,000	---
(o) Relation of insects to azalea flower blight.....	400	400	---	- \$400 (1)
(p) Dissemination of information to the public on methods of controlling forest and shade tree insects, including general inquiries on this subject.....	28,590	28,000	28,000	---
Additional for administrative promotions.....	---	---	2,840	+2,840 (2)
Unobligated balance.....	1,809	---	---	---
Total appropriation.....	253,100	253,100	255,540	+2,440

INCREASE OR DECREASE

The net increase of \$2,440 in this item for 1941 consists of:

(1) A reduction of \$400 made possible by the completion of a special investigation, for which \$400 was provided in 1937 on the relation of insects to azalea flower blight.

(2) \$2,840 additional estimated for administrative promotions in accordance with the plan which is being uniformly applied in the Budget Estimates for 1941.

CHANGE IN LANGUAGE

It is recommended that the proviso contained in this paragraph requiring that \$40,000 of the appropriation for "Forest Insects" shall only be available for expenditures when matched by State funds be eliminated. It is believed that its elimination would be in the interest of economy. Its inclusion serves no useful purpose but requires additional expense in bookkeeping and extra work and delay in planning programs to be carried out. The inclusion of such a proviso in an item which provides funds for investigational work is in conflict with procedures followed on all other research items. To carry out the procedure as now required, it is necessary (1) to secure from the State agencies information as to the amount that they propose to expend during the fiscal year for investigations on forest insects, (2) to have the Secretary consider this

information and specifically approve a recommendation that \$40,000 be made available for expenditures, and (3) when such approval is secured to set up this amount as a separate bookkeeping item.

This proviso has been included in the language providing funds for investigations on forest insects since enactment of the act providing appropriations for the fiscal year 1938. Experience has shown that the expenditures made by States for investigations on forest insects exceed \$40,000. With the increasing interest and demand for information on the control of forest insects, there is every reason to believe that States will continue to expend at least the amounts they are now expending. To continue this requirement appears to serve no valuable purpose.

WORK UNDER THIS APPROPRIATION

This appropriation provides for investigations on insects injurious to forest and shade trees and forest products and for the determination of methods for controlling these pests. It provides for giving advice to land managing agencies on methods of controlling insect pests in forests and for surveys to develop facts regarding infestations and the areas where the control operations should be carried on. It also provides for cooperating with the land managing agencies in planning and directing campaigns to control outbreaks of insects which may affect large forested areas.

The activities are directed by the Division of Forest Insect Investigations from headquarters in Washington. The investigations and surveys are conducted from laboratories located in appropriate localities in the field and usually in the same towns as the experiment stations maintained by the Forest Service. The present field laboratories are located at New Haven, Conn., Morristown, N. J., Asheville, N. C., New Orleans, La., Milwaukee, Wis., Fort Collins, Colo., Berkeley, Calif., Portland, Ore., and Coeur d'Alene, Idaho. The activities are divided into a number of work projects which are briefly discussed in the following paragraphs:

(a) There are nearly 400 different kinds of bark beetles which attack forest and shade trees. Many of these are important pests and particularly those belonging to the genus Dendroctonus which cause extensive destruction in coniferous forests. Bark beetles occur in all parts of the United States. Those which are major pests of coniferous trees occur in all sections. The distribution of the various species is, however, restricted by various factors. Certain of the important species feed on a number of different kinds of pines and in some localities a number of kinds attack the same kind of trees. The various species differ in habits and the method of control and the season when the work can be done depends on the kind of bark beetle but also on locality and the species of tree attacked. Control measures now recommended for important tree killing bark beetles consist very largely of felling the trees and removal or destruction of the bark. These operations are costly and cannot be carried out economically except in connection with logging operations. Further studies on the habits and development of the beetles and experiments to test other methods of control should lead to the development of control measures which can be applied more economically. Some promising suggestions have been obtained. These include the use of penetrating oils in which toxic chemicals

are dissolved and which can be sprayed on the tree so as to kill the insects within or beneath the bark. Investigations on the bark beetles are conducted at practically all of the laboratories, but receive special attention at those located in California, Colorado, Oregon, and Idaho.

(b) There are many different kinds of insects which feed on the foliage of forest and shade trees. By far the greater number of these are native to the United States. Some of the important pests such as the gypsy moth, the brown-tail moth, the willow beetle, etc., have been introduced from foreign countries. The methods of combating these insects on forest and shade trees depend upon the kind of insect and on the kind of tree attacked. The cost of the application of control measures, particularly those applied for the protection of forest trees is an important, and often limiting, factor in protecting trees from leaf feeding insects. The investigations to develop more economic and effective methods of combating various species which feed on the foliage are carried on at many of the laboratories. Particular attention is being directed to the development of methods of control of the canker worm, various tent caterpillars, the bud worms and leaf miners. Work under this project will be intensified during the current fiscal year in an effort to cope with the inroads of the European spruce sawfly, the forest tent caterpillar, and other defoliators.

(c) Many kinds of native insects, especially the larvae of beetles, bore into the wood and bark of forest and shade trees. The habits of the various kinds differ greatly. Some attack the trees only in a weakened condition. Others attack healthy trees. There is close association between insects of this type and those which destroy the foliage or suck the sap. In developing methods for the control of insects attacking forest and shade trees, it is necessary to have information regarding the habits of boring insects which may be associated with primary species in order to give appropriate advice regarding control. Studies to secure needed information on these problems are carried on at most of the field laboratories.

(d) Forest and shade trees are attacked by many different kinds of insects which feed on the juices of the plant. These forms include many species of aphids, scale insects and various other sucking bugs. Certain of these like the beech scale and minute scales which occur at the base of the leaves of pines are intimately associated with plant diseases which attack the trees. Little information is available as to the exact relation between these sucking insects and the disease, and limited studies are under way to obtain more information regarding the insect, its relation to the disease and to develop methods for control. Scale insects and aphids are common pests of shade and ornamental trees, often causing material damage in cases where the infestation causes the trees to die. Experiments to determine controls for some of these species are conducted at certain laboratories, particularly the one at New Haven, Connecticut.

(e) Forest and shade trees in nurseries and in plantations and areas of natural reproduction are attacked by many kinds of insects, native and introduced. The introduced species include the European pine shoot moth and the European pine sawfly which are important pests to nurseries and plantations in

New England and adjacent areas. With the development in conservation which includes much reforesting the control of insects in nurseries and plantations has become a problem of much importance. Such native insects as the white pine weevil, various kinds of white grubs and certain bud worms are limiting factors in the production of satisfactory nursery stock and the production of suitable trees in plantations and areas of natural reproduction. Limited investigations are being carried on to develop more information regarding the methods of combating certain of these pests and to develop economical methods for their control.

(f) Abnormal weather conditions, such as unusual low temperatures and drought, affect the abundance of many different kinds of insects attacking forest trees. Limited studies are being carried on at several western stations to determine the relation of climatic factors to outbreaks of various insects, particularly those caused by tree killing bark beetles. Basic information on this type should have an important bearing on control operations. It has been determined that some of the destructive bark beetles are killed at certain low temperatures. Much work remains to be done, however, in the study of climatic factors, including the correlation of air and bark temperatures.

(g) The most effective way of combating certain kinds of insects that attack forest, shade and ornamental trees is the application of insecticides. The use of insecticides is particularly applicable in combating insects attacking trees used for shade and ornamental purposes as such materials cannot usually be applied over large forested areas. Studies are now under way to determine the dosage and material most effective in controlling various kinds of insects attacking trees used for shade and ornamental purposes and limited studies are under way to develop new types of insecticides which can be economically applied to large forested areas either by the use of ground machines or by the use of various kinds of aircraft.

(h) Small quantities of certain chemicals are known to be toxic to the immature stages of various kinds of insects which feed on the bark and wood of trees. These materials can be injected into the sapstream of the tree and thus carried throughout the tree. Experiments to determine the type of material which can be most effectively and economically used to kill bark beetles by injecting chemicals into the sapstream of the tree are being carried on at the laboratory at Asheville, North Carolina. Further studies on this problem should make it possible to apply this method to other species and in other localities.

(i) The crude forest products are attacked by a wide variety of insects, particularly various kinds of borers. Finished forest products are also subject to attack by boring insects, particularly forms commonly referred to as powder post beetles. Studies are under way to determine methods of preventing various insects from attacking forest products and to develop methods for their control.

(j) Termites cause annual losses of many millions of dollars and are attracting unusual attention because of the increased expansion of building operations adjacent to the larger communities. Many materials are being used by various agencies for killing termites and various new methods are being advocated by certain commercial agencies. To determine the value of these and

develop possible new methods for control, additional emphasis has been placed on investigations on termites. This work is being carried on in New Orleans, La., Asheville, N. C., Beltsville, Md., and in the Canal Zone.

(k) Parasites and other natural enemies of forest insects contribute materially to the control of injurious species. Many different kinds of parasitic and predaceous insects have been introduced to aid in combating insects attacking forest trees, particularly the gypsy moth, brown-tail moth, satin moth, European spruce sawfly, and the European pine shoot moth. Studies to determine the value of these natural enemies in combating these introduced insects are being carried on at the laboratory at New Haven, Connecticut. This laboratory is also engaged in recolonizing various introduced and native parasites and predators which offer promise as aids in controlling injurious species.

(l) Explorations to locate parasites of introduced insects that attack forest and shade trees are being carried on in Europe. Special attention is directed to investigations on parasites of the European spruce sawfly.

(m) Land managing agencies, such as the Forest Service, National Park Service and the Bureau of Indian Affairs, as well as the private timber owners, look to the Bureau of Entomology and Plant Quarantine for advice on methods of controlling insect pests in forests and for planning the necessary control work. To give such advice, it is necessary to conduct surveys to determine the status of insect pests in the forests, locate areas of infestation and secure other information needed in planning control campaigns. The forests of the United States are extensive. To make it possible to secure information as to the status of insects from as much of the area as all available facilities will permit, forest rangers and other engaged in similar tasks are informed on various important pests and aid in assembling information regarding the status of these pests in forest areas where they are located. Reports received from these sources are preliminary in character and before recommendations for control can be made it is necessary to make intensive surveys which can be used as a basis of plans for control operations. The surveys as carried on in the various regions are directed from the field laboratories where close contact and cooperation is maintained with the Forest Service, National Park Service, Bureau of Indian Affairs and various private timber owners.

(n) The Dutch elm disease is transmitted from tree to tree by certain bark beetles. Studies are under way to gain more information regarding those insects known to transmit the disease and to determine whether others may also serve as carriers. In carrying out the eradication work, it is necessary to have definite information regarding the habits of the various insect vectors in order that these may be controlled and thus aid in reducing the spread of the disease. An important feature of the work is to obtain information regarding the flight range of the various insect carriers of the disease, to determine their distribution and the effectiveness of various methods of reducing their numbers.

(p) Many inquiries are directed to the Washington and field offices regarding methods of controlling insects attacking forest and shade trees. The preparation of replies to these various inquiries is a part of the duties of all of the field laboratories and an important part of the work of the Washington office requiring the time of employees stationed here.

(k) BLISTER RUST CONTROL

Appropriation Act, 1940.....	\$300,000
Budget Estimate, 1941.....	403,570
Increase.....	<u>103,570</u>

PROJECT STATEMENT

Projects	1939	1940 (Estimated)	1941 (Estimated)	Increases
1. White-pine blister rust control operations:				
(a) Eastern control program	\$140,040	\$140,800	\$200,290	+59,490 (1)
(b) Western control program	147,926	149,200	189,710	+40,510 (2)
2. Enforcement of quarantine on white-pine blister rust....	9,269	10,000	10,000	---
Additional for administrative promotions.....	---	---	3,570	+ 3,570 (3)
Unobligated balance.....	2,765	---	---	---
Total appropriation.....	300,000	300,000	403,570	+103,570

INCREASES

The increase of \$103,570 in this item for 1941 consists of:

(1) An increase of \$59,490 for the Eastern control program on white pine blister rust.

This increase is proposed in order to revitalize and renew the cooperative features of white pine blister rust control in the Northeastern States, the Central and Lake States, and the Southern Appalachian region. Under the plan of financing the Eastern control program from emergency-fund allotments in recent years, the former educational and survey features of the program in the East, which are essential for the continued maintenance of the cooperative control program in the Eastern white pine forests, have been largely discontinued. With the anticipated reductions in the need for emergency relief of unemployment, it will become more necessary for the individual States, local communities, and private owners to assume a greater share, and eventually perhaps all, of the labor expense of maintaining the control of blister rust. White pine reproduction throughout much of this area is coming in on abandoned fields and similar situations, and the acreage of white pine is materially increasing through natural means in the Northeastern and Southern Appalachian States and through extensive reforestation programs in the Lake States; and the maintenance of blister rust control is necessary for the protection of

these future forests. The blister rust control work was further complicated in the fall of 1938 by the hurricane in New England, which resulted in the blow-down of hundreds of thousands of acres of maturing white pine which is being salvaged. The blow-down will result in regrowth of young white pine and Ribes together in many of these areas, and the leadership of the Bureau in determining what control work needs to be done and for checking its efficiency is essential to the re-establishment of white pine of these areas. The proposed increase will provide for the salary, travel, and incidental expenses of some 22 employees in these Eastern regions to insure the successful maintenance of blister rust control in the over 20,000,000 acres of pine and surrounding control zones in the Eastern United States.

(2) An increase of \$40,510 for the Western control program on white pine blister rust.

This increase is recommended for the purpose of helping to meet a very serious emergency existing in the West due to the extensive destruction of young unprotected Western white pine by blister rust in Idaho, Washington, and Montana, and the danger of further heavy losses on over 800,000 acres of additional forest stands of western white pine not yet reached in the protective program in those States. Blister rust is also becoming established on sugar pine in unprotected parts of the control area in Oregon and northern California and threatens to be disastrous to the future production of that highly valuable and very susceptible species on nearly 3,000,000 acres of forest land in those States. The responsibilities of this Bureau for the leadership of the blister rust control program involve the necessary pine, Ribes, and disease surveys in the Western forested areas, including the National Forests, the National Parks, and other publicly owned land, for the purpose of planning operations in consultation with the cooperating agencies, the development and application of improved methods of eradicating Ribes plants, and checking to maintain and assure the efficiency of field work. The proposed allotment will provide for the salary, travel, and incidental expenses of a considerable number of seasonal employees in the West whose services are greatly needed for the supervision of the Western cooperative control program as carried out with the various public and private agencies administering Western white pine and sugar pine forests.

(3) \$3,570 additional estimated for administrative promotions in accordance with the plan which is being uniformly applied in the Budget Estimates for 1941.

WORK UNDER THIS APPROPRIATION

General.--This appropriation provides technical direction and for leadership campaigns conducted for the suppression and control of white pine blister rust by emergency funds allotted to the Bureau of Entomology and Plant Quarantine, by funds available to the Forest Service, National Park Service, Soil Conservation Service and Indian Service, by funds provided by cooperating states, counties, and towns, and with labor provided by individual land owners. These activities consist of the development and improvement of control practices, the actual field eradication of Ribes (currants and gooseberries), which serve as carriers of the disease, and the application of measures to delay the spread of the disease into uninfected regions including the enforcement of the Federal quarantine on white pine blister rust.

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This work is conducted under two main projects--one concerned with a control program and the other with the enforcement of the Federal quarantine on white-pine blister rust:

1. White pine blister rust control operations.--The work under this project provides national leadership for the control of the white pine blister rust and is carried on in cooperation with the appropriate agencies. For the purpose of convenience, work may be allocated under two main headings depending on the region in which it is carried on:

(a) Eastern control program.--The Department is cooperating in the control of blister rust through formal and informal arrangements with governmental agencies, states, counties, townships, individuals, and other local agencies in the control of white pine blister rust in white pine growing in the States of Connecticut, Maine, Massachusetts, Michigan, Minnesota, New Hampshire, North Carolina, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, Wisconsin, Maryland, Delaware, Virginia, West Virginia, Ohio, Illinois, Indiana, Iowa, Tennessee, Kentucky, Georgia, and South Carolina. In this work the Bureau provides the leadership, technical supervision, and coordination of the control activities, and the states and other cooperating agencies primarily supply foremen and laborers. This applies to work on National Forests, National Parks, and Indian Reservations as well as on state and private lands. The work includes surveys to locate pines and areas where *Ribes* are growing; supervision of control work done by cooperating states, counties and towns, or with emergency funds available to the Bureau or other agencies for white pine blister rust control; and checking eradication work to determine thoroughness and to maintain effective standards of efficiency.

The Eastern control program must be continued (1) to assure the productivity of white pine forests containing standing timber with a stumpage value of over \$100,000,000; (2) to preserve regional scenic and recreational white pine values of great economic importance; (3) to protect thousands of acres of young growth which will form the next timber crop; (4) to maintain control of the disease on initially protected pine lands, aggregating about 17,500,000 acres; (5) to apply control measures on the remaining unprotected pine acreage in the infected states; and (6) as far as possible to extend protection to white pines in disease-free regions before they are invaded by the natural spread of the disease. This is a national problem, requiring Federal leadership, technical supervision, and coordination of the work of cooperating agencies.

(b) Western control program.--In the Western area, the control of white pine blister rust is carried on in the States of California, Idaho, Montana, Oregon, Washington, Wyoming, and Colorado. In this area the Department assists cooperating state and local agencies in the application of control measures on state and privately-owned lands and furnishes leadership, technical assistance, and coordination for control activities carried on in these areas by the Forest Service in protecting valuable white pines in National Forests, and by the National Park Service in protecting valuable

areas of white pines in National Parks. The forested lands in this area are of mixed ownership, and control can be accomplished only by combining and coordinating efforts of all owners into a single program. The work includes surveys to locate pines and areas where Ribes grow; development and application of methods of eradicating Ribes plants; supervision of control work done in National Forests and National Parks, and on private lands with funds supplied from other sources; and checking to maintain effective standards in control work.

The blister rust control program in the Western United States must be continued (1) to assure the productivity of forest lands bearing Western white pine and sugar pine timber with a stumpage value of over \$200,000,000, and thus to maintain industries dependent upon these species of pine, industries which provide 50% of the business of the Western white pine region and which support valuable social, economic, and business interests in the sugar pine regions of Oregon and California; (2) to protect millions of acres of young growth that will form the next timber crop; (3) to prevent forced timber cutting and demoralization of the Nation's lumber markets; (4) to maintain control of the disease in areas already protected; (5) to apply control measures on the remaining unprotected areas; (6) to preserve scenic and recreational white pine values of great economic importance; and (7) as far as possible to extend protection to white pines in uninfected regions before they are invaded by the natural spread of the rust.

2. Enforcement of quarantine on white pine blister rust.--The work under this activity is concerned with the enforcement of the Federal quarantine on account of white pine blister rust. For the most part this work consists of preventing the interstate shipment of rust-infected pines or currant and gooseberry plants likely to carry the disease and not meeting the requirements of the Federal quarantine. Some work is also being done along the line of inspecting the premises and environs of nurseries in which pines susceptible to the disease are grown.

SUPPLEMENTAL FUNDS

	Obligated, 1939	Estimated obligations, 1940
Emergency Relief Appropriation Acts:		
White-pine blister rust control.....	\$1,779,406	\$1,255,709

(1) TRUCK CROP AND GARDEN INSECTS

Appropriation Act, 1940.....	\$381,580
Budget Estimate, 1941.....	<u>370,160</u>
Decrease.....	<u>11,420</u>

PROJECT STATEMENT

	1939	1940 (Estimated)	1941 (Estimated)	Increase or decrease
1. Truck crop insect investigations.....	\$188,728	\$170,413	\$170,413	---
2. Berry insect investigations..	11,138	5,877	5,877	---
3. Sugar-beet leafhopper investigations.....	74,000	73,390	73,390	---
4. Tobacco insect investigations	63,799	88,900	73,900	-\$15,000 (1)
5. Insects affecting greenhouses and ornamental plants.....	42,924	43,000	43,000	---
6. Constructing and equipping a laboratory for investigations of tobacco insects and diseases in North Carolina.....	79,000	---	---	---
Additional for administrative promotions.....	---	---	3,580	+ 3,580 (2)
Unobligated balance.....	1,991	---	---	---
Total appropriation.....	461,580	381,580	370,160	- 11,420

INCREASE OR DECREASE

The net decrease of \$11,420 in this item for 1941 consists of:

(1) A decrease of \$15,000 in the project "Tobacco Insect Investigations" by curtailment of investigations of insects affecting tobacco, particularly the tobacco moth in growers' pack houses.

(2) \$3,580 additional is estimated for administrative promotions in accordance with the plan which is being uniformly applied in the Budget Estimates for 1941.

WORK UNDER THIS APPROPRIATION

General:--This subappropriation provides for research to develop means of controlling insects injurious to truck crops and garden plants including vegetables, flowers, bulbous flowering plants, mushrooms, and plants grown under glass, and includes such related crops as strawberries, raspberries, blackberries, sugar beets, and tobacco. It also provides for investigations on the European earwig, pests of mushrooms, and soil insects such as wireworms and white grubs attacking vegetables. These activities are under the direction of the Di-

vision of Truck Crop and Garden Insects Investigations which has headquarters in Washington. Field laboratories are maintained in certain of the more important trucking regions and in localities where bulbs and other ornamental plants are produced.

These activities are carried on under several projects, which are discussed briefly in the following paragraphs:

1. Truck Crop Insect Investigations.--The activities conducted under this project are concerned with insects affecting truck crops such as beans, peas, melons, potatoes, sweet potatoes, onions, cabbages, etc. Investigations are now being conducted on a wide variety of insects injurious to truck crops, including cabbage caterpillars, tomato fruit worm, pepper weevil, Puerto Rican mole cricket, the European earwig, pea aphid, pea weevil, sweet-potato weevil, Mexican bean beetle, various wireworms and white grubs. Certain phases of these investigations are carried on in cooperation with the Bureau of Plant Industry and the Bureau of Agricultural Engineering. The studies are carried on at some 20 field laboratories located in various parts of the country. For the most part the investigations conducted at a laboratory cover a variety of problems and the laboratory may be considered as regional headquarters for work on vegetable crop pests. For example, the pests of cole crops are studied at four different stations.

The determination of satisfactory methods for the control of insects affecting vegetable and garden crops necessitates investigations on many kinds of insects and crops. These studies are important to many large industries, including canning and marketing agencies, the truck farmers and to home gardeners. The development and expansion of the vegetable industry, the increased consumption of green food products, and the demand that these be free from insect damage and insecticidal residues, are factors which have contributed to the increasing importance of this work. With the concentration of crops in certain areas, old pests have increased in abundance and distribution. Many remedies which have been developed for the control of certain pests of truck crops required the use of insecticides containing arsenic. Where heavy infestations occur the pests cannot be satisfactorily controlled without leaving excessive residues. This coupled with the frequently careless use of insecticides by growers emphasizes the need of developing methods of control which will not leave harmful residues. There is an increasing demand for information on the control of insect pests of vegetables, particularly for remedies which will not leave objectionable residues.

2. Perry Insect Investigations.--The work under this project is concerned with the study of insects injurious to the small fruits known as berries and including strawberries, raspberries, blackberries, etc. Work is carried on at a field laboratory at Puyallup, Washington for problems in the Pacific Northwest. Special attention is being given to development of measures to control the raspberry fruit worm and the red berry mite of blackberries. The work on the raspberry fruitworm is directed to the application of insecticides which do not leave objectionable residues and at the same time reduce the worm infestation to the point that none will be found in the harvested fruit. The production of nonwormy fruit is of paramount importance to the canning industry. The occurrence of large numbers of minute insects called thrips in

cans of raspberries and related fruits produced in the Pacific Northwest emphasized the need of studies to determine methods of controlling this pest which is a menace to both the grower and canner.

3. Sugar Beet Insect Investigations.--This project is concerned mainly with investigations on the sugar beet leafhopper, an important pest of sugar beets and vegetables in the western part of the United States. Its periodic attacks have resulted in almost complete failure of sugar beets, tomatoes, beans, and squashes in certain areas and cause marked reduction in the yields every year. The sugar beet leafhopper transmits the destructive disease known as curly top. One insect may transmit the disease to a number of plants. The leafhoppers invade fields in large numbers in the migration periods and direct control in the fields has not been found practicable. The work on this insect in the different sections varies in scope and is divided into two work projects.

In the Intermountain Region the investigations are carried on from laboratories at Twin Falls, Idaho; Phoenix, Arizona; and Logan, Utah. These studies include surveys to determine the abundance of the beet leafhopper and the availability of their favorite host plants in their natural breeding areas, experiments to determine the value of sprays and trap crops, field surveys to outline the main breeding areas, analyses of factors which make these areas important and determination of how they would be modified by natural or artificial causes. This work also includes a study of insects which affect the production of sugar beet seed.

In California the studies are concerned with the determination of the value of spraying wild host plants and the elimination of breeding areas as a means of control, and the relation populations of the leafhopper have to damage to tomatoes and other truck crops and the production of beet seed. This, of course, involves a series of surveys and migration studies.

4. Tobacco Insect Investigations.--The work under this project is concerned with the study of insects injurious to tobacco both in the field and in storage. It involves studies of the life history, habits and methods of control by the use of insecticides, attractants, baits, fumigants, cultural practices, etc.

The work on insects attacking tobacco in the field is now carried on in four of the main areas which produce various types of tobacco. The work in the dark fire cured area is located at Clarksville, Tennessee; that in the flue cured area at Oxford, North Carolina, supplemented by studies at Florence, South Carolina; that on insects attacking shade grown tobacco at Quincy, Florida; and that on insects attacking tobacco used for cigar wrappers in Connecticut at Windsor, in cooperation with the State Experiment Station. Satisfactory controls that will not leave objectionable residues are not available for the control of many of the important pests, such as the hornworm and flea beetle. Although tobacco is not considered as a food, there is apparently some danger to users from insecticidal residues that may occur on the marketed product. Concerns purchasing tobacco for manufacturing purposes are giving attention to the amount of visible residue that may occur. This emphasizes the need of the development of controls which will eliminate objectionable residues. In the dark fire cured area test are under way to determine the practicability of the use of

poison bait feeders as an aid in the control of the hornworm moth, and work is also being done with several types of traps. Experiments to determine the effect of such insecticides as derris are under way, as well as studies to determine the possibility of using pyrethrum or other organic compounds. The type of bait most effective for the control of the sod webworm is also receiving some attention. The most important pest of tobacco used for cigar wrappers is the tobacco flea beetle. During the past few seasons particular attention has been directed to the use of derris and cube dusts as a control for this pest and results indicate that these materials will be satisfactory for the control of this insect, at least when the value of the tobacco will justify their use. Attention is also being directed to the methods of control of the tobacco thrips.

Investigations on insects affecting tobacco in storage were undertaken some years ago in response to the demand of the tobacco trade of the United States. They are chiefly concerned with the development of methods of controlling the tobacco moth and the tobacco beetle in both the closed and open type of warehouses. Some very useful and interesting information has been secured and such conclusions as to control measures as have been developed have been made available to the trade. Aside from the protection of tobacco produced within the United States, these investigations have a bearing on the production of a product sufficiently free from insects to meet the requirements of countries to which American tobacco is exported. During the curing season of 1938 the tobacco moth was found for the first time in injurious numbers in growers' pack houses. Investigations have been inaugurated to develop methods to meet this situation.

The infestation in closed storages can be materially reduced by the use of traps and fumigants. It is not practical to apply these methods in the open storages, and studies are being made to determine other measures of control such as the use of sprays and dusts. The practicability of using low temperatures as a means of control is also being studied.

5. Insects affecting greenhouse and ornamental plants.--The work under this project deals with investigations to determine methods for controlling insects attacking flowering garden plants such as narcissus, tulip, dahlia, etc., and household and ornamental plants; insects injurious to flowers and all kinds of plants grown under glass; and insects injurious to mushrooms. There are many pests of these plants, and in many cases the control which may be used successfully on one kind of plant cannot be used on other kinds of plants. In determining controls for a given insect pest it is necessary to test them on most of the kinds of plants attacked and to study the control in relation to the culture of the plant. Some of the pests of greenhouse and ornamental plants now receiving special attention are: (1) the cyclamen and broad mites--insects extremely difficult to control which, according to a conservative estimate, cause annual losses to greenhouse interests approximating one million dollars; (2) insect vectors of important mosaic diseases of rose and narcissus--it seems likely that certain of these diseases are transmitted by insects which may be fairly easily controlled; (3) the iris thrips, a widely distributed pest especially difficult to control where the tubers are left in permanent locations; (4) the greenhouse red spider, a pest which attacks a wide variety of plants and causes losses throughout the country; (5) the gladiolus thrips--a limiting factor to the successful production of this favorite garden flower; (6) aphids and white flies attacking greenhouse plants; (7) bulb mites--there are a number of mites which

seriously injure narcissus bulbs and flowers for which satisfactory control measures are not available, and additional facts are needed before all varieties of bulbs can be disinfected to eliminate mites; (8) narcissus bulb flies-- effective methods for disinfecting narcissus bulbs have been developed, but present methods of controlling the pest in the field are not fully effective.

The most important pest problems confronting the producers of mushrooms are maggots and mites. The control measures now available to the commercial producer are not fully effective. Conditions that must be maintained in the house for the satisfactory growth of mushrooms make it difficult to fumigate. Mite control is especially difficult because the fumigants ordinarily used do not penetrate the compost and reach the mite without injury to the mushroom. Progress has been made, however, in the use of nicotine and pyrethrum compounds as drenches for the mushroom beds. Progress has also been made in the development of light traps. Further work, however, is necessary to make these results available to the producer. The chemical problems are being studied in cooperation with the Insecticide Unit.

(m) CEREAL AND FORAGE INSECTS

Appropriation Act, 1940.....	\$383,700
Budget Estimate, 1941.....	<u>369,740</u>
Decrease.....	<u>13,960</u>

PROJECT STATEMENT

Projects	1939	1940 (Estimated)	1941 (Estimated)	Increase or decrease
1. Cereal and forage insect investigations.....	\$252,014	\$273,245	\$256,545	-\$16,700 (1)
2. European corn borer investigations.....	78,955	78,968	78,968	---
3. Sugarcane and rice insect investigations.....	31,200	31,487	31,487	---
Additional for administrative promotions.....	---	---	2,740	+ 2,740 (2)
Unobligated balance.....	1,500	---	---	---
Total appropriation.....	363,669	383,700	369,740	-13,960

INCREASE OR DECREASE

The decrease of \$13,960 in this item for 1941 consists of:

(1) A reduction of \$16,700 for cereal and forage insect investigations, involving discontinuance of a \$2,000 allotment at Manhattan, Kansas for "investigations of insects attacking sunflowers"; discontinuance of a \$3,600 allotment at Urbana, Illinois for "cutworm investigations"; and a reduction of \$11,100 in the allotment at Salt Lake City, Utah for "alfalfa weevil investigations".

(2) \$2,740 additional estimated for administrative promotions in accordance with the plan which is being uniformly applied in the Budget Estimates for 1941.

WORK UNDER THIS APPROPRIATION

General:--This appropriation provides for investigations on insects affecting cereal and forage crops including sugar cane and rice and the development of effective and economical methods for their control. Cereal and forage crops are the basis of agriculture over a large part of the United States. The insects attacking these crops annually cause immense losses, and in some areas crops may be completely destroyed by these pests. The investigations conducted under this item are directed by the Division of Cereal and Forage Insect Investigations from headquarters in Washington, D. C. The studies are conducted at field laboratories located in the important crop areas. The investigations are coordinated with those done by other agencies of the Department on these crops and also with that done by State agencies, certain problems being studied co-operatively. They are carried on under several different projects, which are discussed briefly in the following paragraphs:

1. Cereal and Forage Insect Investigations.--This project provides for investigations to develop effective and economical means of controlling insects affecting corn, sorghums, small grains (except rice), and forage crops. There are hundreds of kinds of insects which attack these crops. Some of these are injurious to both cereal and forage crops, others restrict their activities to single crops. The work now under way is separated into work projects referred to below:

The Hessian fly is the most important single insect pest of wheat. The amount of damage done each year varies with conditions. Surveys are conducted in cooperation with state agencies to determine the status of the pest and give timely information concerning control measures. Investigations are being conducted in cooperation with the Bureau of Plant Industry in certain state experiment stations to determine and breed improved varieties of wheat that are resistant to attack with excellent chances of success. An effort is being made to introduce certain parasites that occur in Europe and are not known to be established in the United States, and to redistribute parasites already established in certain areas in sections where they do not now occur and may be of benefit. The work on the Hessian fly is carried on at Carlisle, Pennsylvania; La Fayette, Indiana; Manhattan, Kansas; and Sacramento, California.

The chinch bug is one of the important pests of corn, small grains and other grass-like plants and occurs generally throughout the eastern half of the country. In favorable years it causes severe losses. The studies on chinch bugs include those directed to determine varieties of corn and sorghum resistant to attack. These are conducted in cooperation with the Bureau of Plant Industry and certain state experiment stations. Those concerned primarily with the insect deal with the development of more effective measures to prevent the migration of the immature bugs from small grains to corn, the development of methods of determining chinch bug abundance, and the determination of the effect agronomic practices have on the abundance of the bugs. Work is headquartered at stations at La Fayette, Indiana; Manhattan, Kansas; and Lawton, Oklahoma.

The corn earworm is the most destructive generally distributed insect enemy of corn in the United States and occurs throughout the country wherever corn is grown. No satisfactory control is known for it in field corn. Studies so far indicate that indirect methods may be useful in reducing the losses in field corn and that certain direct methods such as the application of insecticides may be effectively used for its control in sweet corn. Previous observations suggest that certain characters of the husk may offer partial immunity from attack. Studies are being made on varieties and strains to determine whether it would be practical to carry on intensive breeding to produce relatively nonsusceptible varieties. Because of the importance of the corn earworm emphasis is being placed on the effort to develop effective controls. The activities of the state experiment stations and other units of the Bureau which study it when it attacks other crops are now coordinated into a cooperative program. The field work on this insect as a pest of corn is directed from a laboratory at Urbana, Illinois, and special studies are carried on at Arlington Farm, Virginia; La Fayette, Indiana; and New Haven, Connecticut.

There are many different species of insects which attack small grains and grasses. Among those which are now being studied are the black stem sawfly, the European wheat sawfly, jointworms, straw worms, etc. During the past several years the European wheat sawfly has occurred in outbreak numbers over considerable areas in Ohio and Pennsylvania and caused marked losses to wheat. An effort is being made to colonize an introduced parasite which materially aids in the control of this pest in Europe and is being established in parts of Canada. The work is conducted from many laboratories. Those at Carlisle, Pennsylvania, and Sacramento, California, have during the past year directed special attention to these various pests.

Sunflowers are a potentially important crop in portions of Illinois, Missouri, and New Mexico, and have been used as a substitute in cases of corn failure, particularly in areas along the river bottoms. Sunflower seed has been made practically worthless for oil production, because of severe insect infestations. The pressing of oil from sunflower seed has practically been discontinued in the Illinois and Missouri areas because of the heavy losses caused by insect pests. The work that has been done on this activity was directed primarily towards the determination of varietal resistance and has been in cooperation with the Illinois Agricultural Experiment Station with field studies in Illinois and Missouri.

There are many different kinds of insects which carry diseases of cereal and forage crops. At present particular attention is being directed to those insects which are thought to be carriers of the Stewart's disease of corn. It has been definitely determined that at least two species of flea beetles transmit this disease and that certain other species of insects carry the disease over the winter. It is probable that these insects are the main carriers of the disease in the field. This work is carried on at the laboratory at Arlington, Virginia.

The alfalfa weevil is an introduced pest which occurs in a number of western States. It has caused material losses in many sections and because of its importance has been the subject of state quarantines on the movement of alfalfa. During recent drought years these quarantines have been of special im-

portance because of the restrictions on the movement of hay. Studies on the alfalfa weevil are concerned with surveys to determine spread and occurrence, treatments that may be given to hay to eliminate the weevil, and the effect indirect methods of control--such as proper timing of cuttings--have on weevil abundance and damage. The work now under way on the alfalfa weevil is headquartered at Salt Lake City, Utah. Another foreign weevil closely related to the alfalfa weevil and also attacking legumes was discovered in 1939 in the vicinity of Yuma, Arizona. Studies to determine its importance and the possibility of eradication or control are now in progress there.

The alfalfa aphid causes severe losses in a number of the Middlewestern and Western States which produce alfalfa. Its abundance is somewhat periodic, particularly in the Pacific Northwest. Direct control by insecticides appears impracticable. In recent years certain strains of alfalfa have been discovered which are highly resistant to aphid attack. The study of these and other strains is now under way with the cooperation of the Bureau of Plant Industry and state experiment stations. Certain fungi attack the alfalfa aphid, and work is being done to determine whether it is possible to utilize diseases in field control. The work is carried on at Forest Grove, Oregon; Manhattan, Kansas; and Sacramento, California.

There are a number of insects which attack alfalfa and clover seed or interfere with its development. Among the most important are several species of sucking bugs and the alfalfa seed chalcid. No satisfactory methods of controlling them have yet been established, but biological and ecological studies now in progress give promise of leading to effective control methods in the Western States where the main seed producing areas are located by cleanup of weeds serving as alternate hosts, clean cutting of alfalfa, and proper timing of the hay and seed crops. The possibilities of insecticidal control are also being investigated. This work is headquartered at Tempe, Arizona, and Delta, Utah.

The various forage crops are attacked by many different insects. One of the pests now attracting considerable attention is the vetch bruchid, an introduced insect in the Central Atlantic States, where it has caused high losses in seed production, in some counties as much as 50% of the entire crop, and discovered last year in the vicinity of Portland, Oregon. This insect lives in and may be transported in vetch seed, and certain areas where vetch is produced for seed are in need of information on control measures and ways of treating seed to prevent the spread of this pest. Other important insects which attack forage crops are the Western spotted cucumber beetle, an important pest of alfalfa and clover seedlings in the Pacific Northwest, and the various leafhoppers which attack alfalfa often cause heavy losses in the yield and reduce the vitality of plants so that they are injured by winter killing. Studies on miscellaneous insect pests of forage crops are directed from field laboratories at Arlington, Virginia; Forest Grove, Oregon; and Carlisle, Pennsylvania.

The importance of grasshoppers as pests of practically all kinds of cereal and forage crops has long been recognized and has again been demonstrated by the extensive outbreaks of the past five years in some 24 States. There are many different species of grasshoppers that may occur in such abundance as to do excessive damage. When all the various kinds are abundant during the same season losses may be very great. Various species of grasshoppers differ in their habits, particularly as to associations favorable for egg-laying, and the reaction

to various baits. The kinds which usually are present in cultivated fields are, in the main, quite different from the species which are so destructive range lands of the plains area. Comparatively little attention is being given to these species, except as they migrate into cultivated areas. Special attention is being given to determining more effective and economical baits, especially the development of cheaper ingredients which may be substituted for the standard bran mash now recommended. Emphasis is also placed on ecological factors influencing the abundance of the grasshoppers and the habits of the various economic species with a view to adapting control measures to the prevention of outbreaks. These activities are carried on at the following stations: Bozeman, Montana; Forest Grove, Oregon; Tempe, Arizona; Sacramento, California; and Wichita, Kansas.

One of the most effective ways to prevent the building up of large outbreaks of grasshoppers such as have recently occurred is to locate centers of incipient infestations and apply control before the infestation builds up to outbreak proportions. To secure information of this nature surveys are carried on in cooperation with various state agencies. In this work the states contribute substantial cooperation. Its value has been clearly shown in the past 5 years. The information secured from the cooperative survey is, of course, available to the responsible state agencies and serves as the basis for the organization of cooperative control work the following season. Without it, it would be impossible to intelligently direct informational work about the outbreaks or distribute bait materials made available from various sources. The continuation of this survey work will develop facts which should serve as an insurance against further outbreaks and avoid the necessity of large appropriations for control. What is equally important, however, is that this survey work will also assemble data on occurrence and distribution in relation to environmental factors, information essential in the development of control measures, improvements in survey methods, and a definite policy on ways of combating these important pests.

During the past three years, the Mormon cricket and its near relative, the Coulee cricket, have occurred in unusual abundance in certain sections in the Intermountain and Great Plains States. In combating these outbreaks the need for more effective and readily applicable methods for control has been emphasized, as well as information as to the causes of outbreaks and the possibility of carrying on measures to prevent their occurrence. The work now under way includes studies to improve direct methods of control and observations on biology, status, and distribution.

White grubs, the immature stage of June beetles, are important pests of sod lands and cereal crops. Serious damage has occurred over considerable areas in the North Central States region in the past few years, and there have been heavy losses in many isolated sections throughout the United States. The damage is done by the grub and also by the adult beetles. There are many native species of white grubs. The life history of various forms differs--some species complete their life cycle in one year, while others may extend it for two, three, or four years. Methods now available for the control of white grubs are unsatisfactory. In an effort to develop more effective control, studies are being conducted on distribution, habits, food preferences, effect of different crop rotations on abundance, and insecticidal control, in cooperation with the State Experiment Stations at Lafayette, Indiana and Madison, Wisconsin.

Cutworms, the larvae of various species of moths, annually cause material losses to cereal and forage crops. At present studies on cutworms are being carried on by the laboratory at Manhattan, Kansas, to determine the habits and distribution of different species affecting cultivated crops and pastures, study their parasites and diseases, and develop improvements in poison baits. Observations are made at various other places throughout the country to determine the flight period of various moths of species known to be of economic importance.

Many of the common pests of cereal and forage crops are attacked by fungous diseases. Comparatively little is known regarding these diseases or conditions under which they may become abundant. Investigations are conducted in the laboratory at Forest Grove, Oregon, and at Arlington, Virginia, to determine the possibility of using diseases as an aid in control.

It is conservatively estimated that 5% of the cereals are destroyed or damaged by various insect pests during the process of milling and while the grain or products are held awaiting milling or shipping. These losses approximate \$300,000,000 annually and are caused by only a comparatively few species which occur throughout the world. Investigations on insects attacking grain during storage and milling are headquartered at Manhattan, Kansas. The studies are carried on in the main milling centers in the vicinity of Kansas City, Missouri, and Minneapolis, Minnesota, and are directed to securing accurate information regarding more effective control methods. One of the standard ways of control is to fumigate and special attention is given to determining the effect of various dosages of fumigants used, to devising more effective methods of applying fumigants, and to determining the practicability of using vacuum as an aid in eliminating infestation on mill products. These involve the determination of the temperature conditions under which fumigation can be effectively conducted in various types of mills and storages as well as the effect of wind and other climatic factors on various fumigants and dosages.

Many of the insect pests of cereal and forage crops were accidentally introduced into the United States during colonizations. Their natural enemies in many cases were left behind. Effort is being made to import these. At present special attention is being given to the importation of parasites of the hessian fly, the European wheat sawfly, and the vetch bruchid.

The white-fringed beetle, a recently introduced pest known to be established in limited areas in Florida, Alabama, Mississippi, and Louisiana, attacks a wide variety of plants and is especially destructive to cotton, corn, legumes, and vegetable crops. Intensive study of its biology and habits is essential to the eradication, suppression, and control measures now being conducted with funds provided under the general authorization for the control of incipient and emergency outbreaks of insect pests. These funds are not available for research. To meet the immediate needs for much needed basic information small amounts were allocated from appropriations for research pending consideration of request for funds for this purpose. The Act providing appropriations for the current fiscal year included an increase of \$20,031 for investigation of the white-fringed beetle. The investigations are conducted from laboratories at Florida, Alabama; Gulfport, Mississippi; and New Orleans, Louisiana. In addition to the amount provided from this appropriation the States of Florida, Alabama, Mississippi, and Louisiana contribute approximately an equal amount for

investigations on this pest.

2. European Corn Borer Investigations.--This project provides for the entomological phases of investigations on the European corn borer. Its objectives are the origination and perfection of effective and economical methods to control the pest and surveys to secure facts as to its status. Special attention is now being given to determine methods of controlling the insect by the use of insecticides. Work on varieties of corn resistant or tolerant to the borer is conducted largely at Toledo, Ohio, and the occurrence of definite resistance in field corn has been determined. A large number of strains are being studied for selection of those suitable for use in breeding commercially-desirable resistant varieties. Field studies are being conducted to determine the effectiveness of mechanical and cultural measures of control. The relation between single and multiple generation strains and their food requirements are also being studied. The colonization and introduction of parasites is directed largely to the establishment of these natural aids in areas where they do not now occur, especially in western Massachusetts, Connecticut, Long Island, New Jersey, and the newly infested sections of Maryland and Virginia. Surveys to determine general distribution, abundance, and status are continuing and form an important part of the work having a bearing on research and control activities.

3. Sugarcane and rice insects.--This project provides for investigations on insects attacking sugar cane and rice. Headquarters are maintained at Houma and Crowley, Louisiana, and Beaumont, Texas. Special attention is now being given to the following activities.

The sugar cane moth borer annually causes very excessive losses to cane in the United States, reducing the yield by boring in cane to be harvested and injuring the stand by attacking seed cane. Studies are now under way to determine the susceptibility of different varieties of cane to moth infestation and to determine characters responsible for resistance and attractiveness. Indications are that certain varieties with a hard rind are less attractive and less susceptible to attack. Information regarding these varietal differences may offer a measure of protection from the cane borer. Studies on this insect also include the possibility of utilizing insecticides, cane trash disposal, and parasites as means of control.

Certain insects transmit various diseases of cane, particularly the mosaic disease, which is an important limiting factor in the production of cane in Louisiana. The recent discovery of two other species of aphids which carry certain of the mosaic diseases may offer an explanation of the variation in the severity of these diseases on different plantations and locations. The determination of further information about these and other vectors and their relation to corn and native grass hosts, particularly those attacked by mosaic diseases, and the effect of attending ants on the abundance of aphids needs further study. Studies on the insect vectors of these diseases are being carried on in cooperation with the Bureau of Plant Industry.

Among the other insects attacking sugar cane are the sugar-cane beetle, which also attacks rice and often causes material losses to both crops, the sugar-cane mealybug, wireworms, and the lesser cornstalk borer. Investigations

to determine methods of controlling these pests by artificial and cultural means are under way.

A condition known as "pecky" rice causes excessive annual losses. This condition is caused by the feeding the rice stink bug and certain attendant fungous diseases on the rice in the field, the results of which are evident in harvested and stored grain. Investigations to determine methods of controlling the insect responsible for this damage are under way in cooperation with the Bureau of Plant Industry and the Louisiana Experiment Station. Studies are also being made of the rice stalk borer and of insects which attack the crop in the field and remain with the harvested rice to do further damage in mills and warehouses.

Until about three years ago very little work had been done on the control of various pests seriously injuring rice in storage. Experiments begun in a limited way to determine the effect of various fumigants, methods of application, and the dosage required to control some of the commoner pests in rice mills and in warehouses where rough and cleaned rice are stored have produced promising results and are being continued.

(n) EUROPEAN CORN BORER CONTROL

Appropriation Act, 1940.....	\$32,939
Budget Estimate, 1941.....	<u>28,239</u>
Decrease.....	<u>4,700</u>

PROJECT STATEMENT

Projects	1939	1940 (Estimated)	1941 (Estimated)	Increase or decrease
Inspection and certification of products regulated by quarantines on the European corn borer.....	\$26,739	\$32,939	\$27,939	-\$5,000(1)
Additional for administrative promotions.....	---	---	300	+ 300(2)
Unobligated balance.....	6,200	---	---	---
Total appropriation....	32,939	32,939	28,239	- 4,700

INCREASE OR DECREASE

The decrease of \$4,700 in this item for 1941 consists of:

(1) A reduction of \$5,000, made possible by a decrease in the inspection and certification of products originating in infested areas.

(2) \$500 additional estimated for administrative promotions in accordance with the plan which is being uniformly applied in the Budget Estimates for 1941.

WORK UNDER THIS APPROPRIATION

This item provides for the certification of products originating in the infested areas to meet the requirements of State quarantines on account of the European corn borer. To secure protection from the artificial spread of the corn borer, following the removal of the Federal quarantine, many States issued quarantines prohibiting or regulating the entry of products that may carry the borer from the infested area. Certain products may be safely moved after adequate inspection. To provide for this inspection and certification the Bureau is cooperating with various States and certifying such products going to States which maintain corn-borer quarantines but do not recognize State certification.

(o) BARBERRY ERADICATION

Appropriation Act, 1940.....	\$175,000
Budget Estimate, 1941.....	<u>176,460</u>
Increase.....	<u>1,460</u>

PROJECT STATEMENT

Projects	1939	1940 (Estimated)	1941 (Estimated)	Increase
1. Eradication of the barberry in the 13 States where work was begun in 1918.....	\$173,436	\$149,550	\$149,550	---
2. Eradication of the barberry in other States.....	20,850	20,800	20,800	---
3. Inspection of nurseries which ship barberberries interstate.....	4,565	4,650	4,650	---
Additional for administrative promotions.....	--	--	1,460	+\$1,460(1)
Unobligated balance.....	1,149	--	--	---
Total appropriation....	200,000	175,000	176,460	+ 1,460

INCREASE

(1) \$1,460 additional is estimated in this item for administrative promotions in accordance with the plan which is being uniformly applied in the Budget Estimates for 1941.

WORK UNDER THIS APPROPRIATION

This appropriation provides for cooperation with States, individuals, and other agencies in the eradication of the common barberry, the intermediate host of black stem rust fungus. The purpose of this work is to control black stem rust of wheat, oats, barley, and rye, and prevent the occurrence of epidemics of this disease. The work consists of locating and removing bushes of those species or varieties of barberry which serve as intermediate hosts of the fungus. Federal funds are used largely for the supervision and coordination of the work of state and local agencies which supply labor and inspectors and share in the expenses of scouting. Barberberries may resprout from portions of roots left in the ground or be produced from seeds which have lain dormant on the ground for some time. It is, therefore, essential that the areas be re-inspected to insure that the plants have been eliminated.

The work of eradicating rust-susceptible barberberries was begun in 1918 in the following thirteen states: Colorado, Illinois, Indiana, Iowa, Michigan, Minnesota, Montana, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin, and

Wyoming. Similar work, conducted in grain-producing sections of Missouri, Pennsylvania, Virginia, and West Virginia, since 1935 has resulted in a very marked improvement in the yield and quality of oats, wheat, and barley in localities in which initial control has been accomplished. These programs, of prime importance from the standpoint of protecting local subsistence and feed crops, also help to prevent regional epidemics of the disease from developing and spreading into adjoining states. This is especially the case in Missouri where existing barberry bushes are a menace to crops in Illinois, Iowa, and the important spring-wheat growing states of Minnesota, North and South Dakota.

A Federal quarantine prohibiting and regulating the movement of barberry plants is enforced, and a small part of this appropriation is used for the inspection of nurseries which ship barberry plants interstate. Certain varieties of barberry are immune to the disease and under appropriate inspection and certification can move without risk. The movement of rust-susceptible varieties is prohibited.

During the last five years the work of destroying barberry plants has been materially increased by special allotments of emergency funds available for relief. This work has put the program ahead a number of years with corresponding benefits. All these activities have been and are being directed with the trained regularly-employed personnel and without them could not be undertaken. The bulk of the regular appropriation is expended for this supervision, although a small portion of the regular funds will be used for necessary checking of work done, the coordination of work with local agencies, and directing appropriate educational campaigns. The present estimate contemplates that emergency funds will continue to be available.

The benefit from the eradication of barberry in grain areas is well recognized and farmers, farm organizations, milling and railroad interests, and farm machinery groups support and endorse the work. State, local, and other agencies cooperate and support it. There has been a substantial reduction in the general damage from stem rust since the beginning of the campaign.

SUPPLEMENTAL FUNDS

	Obligated, 1939	Estimated obligations, 1940
<u>Emergency Relief Appropriation Acts</u>		
Barberrey eradication.....	\$1,203,670	\$854,887



(p) COTTON INSECTS

Appropriation Act, 1940.....	\$144,544
Budget Estimate, 1941.....	<u>145,524</u>
Increase.....	<u>980</u>

PROJECT STATEMENT

Projects	1939	1940 (Estimated)	1941 (Estimated)	Increase
1. Cotton boll weevil investigations.....	\$56,186	\$49,404	\$49,404	---
2. Investigations on miscellaneous cotton insects.....	55,850	65,090	65,090	---
3. Thurberia weevil investigations.....	3,960	---	---	---
4. Pink bollworm investigations.....	27,838	30,050	30,050	---
Additional for administrative promotions.....	---	---	---	+ \$980 (1)
Unobligated balance.....	710	---	---	---
Total appropriation....	144,544	144,544	145,524	+ 980

INCREASE

(1) \$980 additional is estimated under this item for administrative promotions in accordance with the plan which is being uniformly applied in the Budget Estimates for 1941.

WORK UNDER THIS APPROPRIATION

General.--This appropriation provides for investigations on insects which attack cotton plants and crude cotton products and for the development or improvement of methods for their control. Cotton is one of the important agricultural crops and one on which the agriculture of the South depends. The products produced from cotton form an important part of industrial occupations in many sections of the United States. Cotton is attacked by many different kinds of insects. The importance of the various species varies with the season and the locality. One of the outstanding pests is the boll weevil. Investigations under this appropriation are carried on in cooperation with the States whenever practicable, but comparatively few States are engaged in investigations on insects attacking cotton. Those phases of the studies having relation to other activities of the Department are carried on in cooperation with the interested bureaus. The work is directed by the Division of Cotton Insects, with headquarters in Washington, D. C., and field laboratories are maintained in localities favorable for the investigations.

1. Cotton boll weevil investigations. --This project provides for investigations on the boll weevil, the most important cotton pest in the South, and the development and improvement of measures for its control. The scope of studies under way covers a wide field. Some of the more important lines of work under way are explained in the following paragraphs:

Cage tests are being made to determine the toxicity of new insecticides developed by other units of the Bureau. Similar tests are made for new combinations of insecticides which have been applied. Comparisons are made with the standard, calcium arsenate, and the effect these materials or combinations have on the cotton plant determined. These cage tests are used as the basis for field tests.

New and promising insecticides or combinations of insecticides are tested in the field in comparison with the measures now recommended. The standard insecticide, calcium arsenate, is not satisfactory under all conditions, and field tests are made to determine the possibility of modifying applications or adding other insecticides to each application to improve its effectiveness. The details for the control of the boll weevil differ in various parts of the cotton belt and accurate information is not available for certain sections as to the most effective time to apply the standard calcium arsenate method to secure effective control. The field studies also include tests to determine whether it is practicable to reduce the amount of calcium arsenate in the earlier applications or whether it is practicable to eliminate them and use molasses-calcium arsenate mixtures or substitute sulphur or other non-arsenicals. The work is conducted from laboratories in South Carolina, Georgia, Mississippi, Louisiana, Florida, and Texas.

In certain areas, particularly those along the Atlantic Coastal Plain, calcium arsenate and other arsenicals appear to have a deleterious effect on certain types of soil. Studies are under way to determine the effect insecticides used for control of the boll weevil have on cotton, forage or truck crops that may later be planted in these soils.

Certain native parasites are known to attack the boll weevil and studies are under way in cooperation with various states to determine the seasonal and geographical distribution and abundance of these parasites and to ascertain the relation they may have to other insects and environmental factors. In certain sections natural enemies are more effective in reducing the weevil damage than in others. The reasons for these variations in effectiveness in different localities are not understood and studies are under way with the hope of determining the factors which affect the abundance of natural enemies and if it is practical to increase the effectiveness of the native parasites through cultural practices or other means.

Studies are under way to determine if any of the species, varieties or strains of cotton show resistance or tolerance to attack by the boll weevil, and to discover characters that may increase the resistance to attack or reduce the damage by the boll weevil. The early development of a tough carpel lining and a thick wall in cotton bolls are desirable characters which tend to reduce feeding and oviposition by the weevil. This work is carried on in cooperation with the Bureau of Plant Industry, with main headquarters at Stoneville, Miss.

The boll weevil is apparently largely restricted to cotton, but it will attack certain other malvaceous plants. Studies are under way to determine how important these plants may be as hosts.

2. Investigations on miscellaneous cotton insects.--This project provides for investigations on the distribution, life history, and habits of many insects which attack cotton and the development of control measures for those which are particularly injurious. In some sections various native insects are more important as pests of cotton than is the boll weevil, and in all parts of the main cotton belt their control has to be considered and timed in connection with that applied for other pests. Some of the problems now receiving special attention are:

The cotton flea hopper and closely allied insects cause the cotton plant to shed squares. They are very important pests and often cause extensive damage over wide areas. In the coastal plain section of Texas the cotton flea hopper is the most important cotton pest. Investigations to determine methods of control by the use of insecticides and by cultural practices are under way. These studies are centered at Waco, Texas.

The cotton bollworm causes considerable damage to cotton and in many parts of the western section of the main cotton belt is considered the most destructive cotton insect pest. Studies to determine the relation of this pest to environmental factors, the effectiveness of insecticides or repellents to the moth, and the possible value of natural enemies are under way. Its control by insecticides is difficult, because they must be applied before the worms enter the bolls. Much of this work is carried on from the laboratory at Waco, Texas, and is done in cooperation with the Texas Agricultural Experiment Station and the Soil Conservation Service. Special attention will be given to determine the effect of conservation measures to insect abundance and damage.

Root aphids are pests of considerable importance in the eastern part of the cotton belt, particularly along the Atlantic Coastal Plain. Studies for control by cultural practices and insecticides are being carried on at Florence in cooperation with the South Carolina Experiment Station. There are at least three species involved and the host habits, particularly the relation to certain weeds and grasses, have an important bearing on control. Control is further complicated by the ants that distribute and protect these aphids.

Preliminary investigations indicate that Fusarium wilt of cotton may be disseminated by insects which occur commonly in cotton fields. Studies to determine the part insects may play in spreading cotton diseases are being carried on in connection with other investigations.

At least six different species of true bugs are serious pests of cotton, in regions where it is produced under irrigation. These pests cause shedding of squares and young bolls and stain the lint, thus materially lowering its quality. Studies to determine the relation of these bugs to their native host plants, and the practicability of controlling the insects by the use of insecticides or cultural means are under way. Much of this work is being carried on in Arizona, with field headquarters at Tucson. Due to a curtailment in investi-

gations on the *Thurberia* weevil, it has been possible to place increased emphasis on this work during the current fiscal year.

Comparatively little is known about the various soil-inhabiting insects which injure cotton. There are many different kinds, some of which cause considerable injury in certain localities. A study is under way to determine the species involved in various types of soils and to determine methods for control in sections where this is required.

Some of the native pests of cotton, such as the red spider, cotton stainer, leaf perforator, crickets, and flea beetles occur in outbreak numbers periodically and cause important losses over considerable areas. Effective means of controlling many of these are not known. Studies to determine the life history and habits of these pests and how they can be controlled are under way in the various field laboratories, particularly those at Tallulah, La., and Florence, S. C.

3. Thurberia weevil investigations.--This project provided for investigations of the life history, habits, and development of control measures for the *Thurberia* weevil, the western form of the cotton boll weevil which is confined to the limited portions of the cotton-growing area of southeastern Arizona and parts of Mexico. This insect is a dry-land form of the cotton boll weevil and has as its native host wild *Thurberia* cotton, which is generally distributed throughout the mountainous regions of the Southwest. This weevil has adapted itself to cotton and is a potential enemy to cotton production in the arid regions. Its habits differ from those of the boll weevil, and in limited areas around Tucson it has demonstrated that it can do material damage to cultivated cotton. The investigations which have been conducted on the insect over a period of years have assembled information needed under its present distribution, and effective measures for control have been developed. The special studies were concluded last fiscal year.

4. Pink bollworm investigations.--This project provides for investigations on the pink bollworm to develop needed facts regarding its life history and habits and improve and develop new control measures which may be used in combating the insect in the limited sections of the United States where it has become established. These investigations will also serve as an insurance by providing additional information regarding means of controlling or eradicating this pest should it become established in new areas. The work is carried on in cooperation with the Texas Agricultural Experiment Station and the Mexican Department of Agriculture, the Bureau's laboratory being located at Presidio, Texas. The following paragraphs briefly discuss some of the problems being studied:

Breeding and colonization of introduced parasites: Three species of parasites have been introduced from Egypt, two from Europe, two from Japan, and two from Hawaii. These are being bred in the laboratory at Presidio and liberated in Puerto Rico (through the Division of Foreign Parasites) and the heavily infected sections along the Mexican border in both the United States and Mexico. Incidental studies on native parasites are also being carried on as part of this activity.

The use of insecticides: This work is being studied in the laboratory and in the field to determine the toxicity of various materials and the possibility of applying them under field conditions to reduce or control this pest. Increased emphasis is being placed on this work during the current year.

Studies on control by cultural means include experiments to determine the effect of plowing and irrigation on the overwintering larvae, and to develop machinery which can be used in cleaning the field of crop remnants.

Observations on the life history and habits are being made to determine the effect of various conditions on survival and hibernation. These studies are being conducted in a large field cage, in which it is possible to control the infestation.

(a) PINK BOLLWORM AND THURBERIA WEEVIL CONTROL

Appropriation Act 1940:

"Pink Bollworm Control".....	\$906,800 (a)
"Thurberia Weevil Control".....	2,808 (a)
Total available, 1940.....	\$909,608
Budget Estimate, 1941.....	527,920
Decrease.....	<u>381,688</u>

(a) The items "Pink bollworm control" and "Thurberia weevil control", carried separately in the 1940 Appropriation Act, are consolidated in the 1941 estimates under the title "Pink bollworm and Thurberia weevil control".

PROJECT STATEMENT

Projects	1939	1940 (Estimated)	1941 (Estimated)	Increases or decreases
1. Pink bollworm control operations:				
(a) Supervision of treatment and movement of cotton or cotton products as required by Federal quarantine on pink bollworm..	\$148,583	\$169,500	\$185,578	+36,078(1)
(b) Inspection within regulated area to determine status of pink bollworm..	27,933	30,000	30,000	---
(c) Inspection outside regulated area to determine possible presence of pink bollworm.....	99,529	115,000	136,100	+21,100(2)
(d) Cleanup operation for control and eradication of pink bollworm.....	90,179	53,785	83,799	+30,014(3)
(e) Field clean-up for suppression of pink bollworm in Lower Rio Grande Valley.....	---	460,000	---	-460,000(4)
(f) Vehicular inspection to determine compliance with quarantine on pink bollworm.....	12,467	25,000	25,000	---
(g) Eradication of wild cotton in Florida for protection against infestation of pink bollworm.....	66,751	53,515	53,515	---
(h) Thurberia weevil control.....	2,784	2,808	2,808	---
Additional for administrative promotions.....	---	---	1,120	+1,120(5)
Unobligated balance.....	1,382	---	---	---
Total appropriation...	449,608	909,608	527,920	-381,688

INCREASES OR DECREASES

The net reduction of \$381,688 in this item for 1941 consists of:

(1) An increase of \$36,078 for supervision of treatment and movement of cotton or cotton products as required by Federal quarantine on pink bollworm.

The addition to the quarantined area of Maricopa County, Arizona, and the counties of Brooks, Jim Wells, Kleberg, Nueces, Duval, Jim Hogg, La Salle, Maverick, Zapata, Webb, Dimmit, Frio, Zavala, Concho, Irion, Mitchell, Sterling, Tom Green, and part of Coke in Texas to the area regulated under the pink bollworm quarantine adds sections which produce a large volume of cotton each year. In these new areas are located approximately 130 processing plants that have to be supervised. The proposed increase is necessary to finance the salaries and expenses of inspectors to enforce the quarantine regulations in these areas.

(2) An increase of \$21,100 for inspection outside the regulated area to determine possible presence of pink bollworm.

The purpose of this increase is to provide for intensive inspection in territory adjacent to the newly infested areas in Arizona and Texas in order to locate the possible presence of the pink bollworm so that steps may be taken to prevent its spread from those areas where infestation may be found. Vigilant inspection to detect newly established infestations is the only known way of preventing these areas from becoming centers of infestation which would spread over much wider areas. The proposed increase would cover the salaries and operating expenses of some 20 seasonal inspectors and laborers under their direction.

(3) An increase of \$50,014 for clean-up operations for control and eradication of pink bollworm.

This increase is needed in order to intensify the work being carried on in cooperation with the State of Arizona to eradicate the infestation in the Salt River Valley. A heavy infestation was found in this area in 1929. This was eradicated by 1931, the work discontinued and the quarantine removed. A new light infestation was discovered in 1938, and an effort is now being made looking to its eradication. The State is actively cooperating in this effort and has provided special funds for this purpose. So far they have contributed about half of the amount expended and it is expected that similar cooperation will continue. The proposed increase would be expended for seasonal help, supplies, materials and equipment, and travel.

(4) A decrease of \$460,000 due to the completion of the field clean-up for suppression of pink bollworm in the Lower Rio Grande Valley.

(5) \$1,120 additional is estimated for administrative promotions in accordance with the plan which is being uniformly applied in the Budget Estimates for 1941.

CHANGE IN LANGUAGE

The Budget Estimates for 1941 provide for the consolidation of the two items "Pink bollworm control" and "Thurberia weevil control" under the new title "Pink bollworm and Thurberia weevil control"; and the language of the paragraph has been amended to accomplish this result.

WORK UNDER THIS APPROPRIATION

This item provides for activities concerned with the prevention of artificial spread of pink bollworm from the infested area, including the enforcement of the Federal domestic quarantine; control operations in the area along the Mexican border contiguous with the infested area in Mexico; eradication activities in isolated points where infestation is detected; inspections to determine presence of the worm; surveys and control operations in Mexico in cooperation with the Mexican Government or local Mexican authorities; and other related work to protect the cotton culture of the United States from this pest.

The pink bollworm is the most destructive pest of cotton and is generally established in all important cotton countries, except the United States. In the United States it occurs in limited areas in Texas, New Mexico and Arizona adjacent to infested sections in Mexico and to a limited extent in non-commercial wild cotton growing on the Keys and part of the mainland of southern Florida. In times past it has gained limited establishments in other sections of the United States from which it has been eradicated. Such isolated areas of infestation occurred in northern Florida, southern Georgia, Louisiana, Texas and Arizona.

It is not believed possible that the insect can be eradicated from the infested areas in sections adjacent to sources of infestation in Mexico by action taken by our country alone. The occurrence of these infestations is a continual menace to the cotton culture of the United States. Public No. 351, 76th Congress directed the Secretary of Agriculture with the assistance of the Secretary of State to discuss this situation with appropriate officials of Mexico for the purpose of preparing plans looking toward the eradication and control of this insect in the United States and Mexico. The report on these discussions is not yet completed but will be made as required by the law. These estimates for 1941 were prepared entirely independent of such discussions. The work now under way is directed (1) to the eradication of the infestation in southern Florida, including the elimination of non-commercial wild cotton to remove this source of possible spread; (2) the eradication of the isolated infestation in the Santa Cruz and Salt River Valleys of Arizona; (3) the enforcement of regulatory measures to prevent artificial spread from known infested sections; (4) carrying on, in cooperation with States where infestation occurs and Mexico, suppressive measures to reduce the population in areas of infestation along the Mexican border to lessen the possibility of natural spread; and (5) scouting to determine possible infestation in new areas and the status of the pest in known infested areas. These are of a continuing nature and are of interest to the entire cotton producing area and all its associated interests.

The various lines of work now carried on are discussed in the following paragraphs.

The quarantine requirements in various parts of the regulated area differ in some details, depending on conditions of infestation. In all areas the seed is sterilized and its handling at oil mills, etc., regulated. In some sections where the infestation is heavy the lint has to be fumigated and compressed before it can be shipped. All the gins, oil mills, compress and fumigating plants in the infested area have to be supervised to see that they comply with necessary safeguards. All cotton products which may leave the quarantine areas have to be certified. These operations are closely associated with the marketing of the crop and the work must be handled in an effective manner to give required protection, and adequate provision must be made for the orderly handling of the crop.

There is need for careful and thorough inspection within the regulated areas to determine conditions of infestation. The regulations enforced differ as between lightly and heavily infested areas, and the determination as to this degree of infestation can best be made by gin trash machines. Their use cannot be replaced by any other form of inspection with equal efficiency and economy. The cost to producers of compliance with the regulations in the sterilization of seed and lint is directly affected by the information obtained from the use of these machines within the regulated area.

The operation of the quarantine depends, of course, upon an accurate knowledge of the distribution of the pest. The fact that the pink bollworm does or does not exist in this country outside the regulated area must be determined for obvious reasons. The cheapest and most efficient way to do this would be through the use of gin trash machines throughout the cotton-growing areas. Since this cannot be accomplished under the appropriation, the alternative is to provide a substitute for gin trash inspection through the collection of bolls from all areas of the main cotton belt. These are kept in preservatives and inspected in laboratories.

The development of machines capable of segregating gin trash, leaving the larvae of the pink bollworm readily exposed to view in an almost negligible quantity of trash, has brought this type of inspection to a point which justified its consideration as an item altogether separate from that of Scouting, although it is an essential part of the scouting work. These machines have been improved from year to year and are now mounted on trucks, which enables them to be moved readily from one location to another. Since it is not necessary to tear down and set up the equipment, machines may be moved from gin to gin or locality to locality under their own power as circumstances may require and the efficiency of the work is greatly increased. The use of these machines at gins in and out of the regulated area furnishes a more comprehensive knowledge of the pink bollworm conditions throughout the entire cotton belt. Inspection with the aid of the gin trash machine furnishes the most positive evidence with respect to the presence or absence of the pink bollworm in a given locality. It is this inspection on which greatest reliance is placed for the finding of infestations of pink bollworm before they have time to become thoroughly established and spread over considerable areas. These surveys are in the nature of insurance and to give the protection necessary have been augmented by the use of additional funds provided for the current year.

The laboratory inspection and gin trash inspection are supplemented by a third method of determining the presence or absence of the pink bollworm. This third method consists of field inspection. It is used in areas outside the regulated area where some reason exists for suspecting possibility of infestation and where it is important to discover this infestation at the earliest possible moment, and where the infestation must be traced to definite fields of growing cotton.

The most heavily infested section in the regulated area is in the Big Bend area of Texas. Cotton heavily infested with the pink bollworm in Mexico is separated only by a little more than the width of the Rio Grande from growing cotton in the United States, infestation being heavy on both sides. A general program of suppression and control is maintained in this area on the American side of the border. This includes time of planting, field clean-up and other operations to reduce the infestation and the hazard of spread because of the occurrence of large numbers of moths and worms. The state of Texas, as well as county authorities, cotton growers and others, is cooperating in this work. The same type of operations is carried out on the Mexican side of the line by the Mexican government, the officials of which cooperated in developing the procedure to be followed.

The occurrence of the light infestations in limited parts of Arizona presents a menace to cotton culture in the adjacent sections and is separated from the area contiguous to the infested sections along the Mexican border. An effort is being made to eliminate these infestations. This requires cleaning the fields after harvest and carrying on other operations in addition to those conducted in other parts of the regulated area. The state of Arizona is actively contributing in the work and supplies funds and means.

INFESTATION IN THE LOWER RIO GRANDE VALLEY

The infestation in the Lower Rio Grande Valley of Texas and adjacent sections of Mexico is of special importance. Spread from this area cannot be prevented by the enforcement of quarantine measures alone, since the infested section is a part of the area of continuous cotton production and the moth may move long distances by natural means. Field clean-up and other measures have been carried on in addition to those enforced to prevent spread by artificial means. It is hoped that by these intensive operations it may be possible to eradicate the infestation on both sides of the river without resorting to the more drastic procedure of a non-cotton zone. The Mexican officials are cooperating in the work and the same type of program is under way in both countries through this section of infestation. The state of Texas, local agencies and individuals are cooperating in the work being done in that state. To intensify the clean-up in Texas and get the work done shortly after harvest \$460,000 was appropriated for the current fiscal year. This work has been completed. With the cooperation of the Texas State Department of Agriculture the fields in south Texas were cleaned as promptly as possible after harvest, and crop residues were destroyed. Partial payment on a per acre basis of the cost of the cleaning was made to the owner or tenant of each field to secure earliest possible compliance with the clean-up program. As a result, it is believed all standing cotton had been plowed and the stalks destroyed or adequately buried prior to the expiration of the allotted time for this program.

On the Mexican side a very fine degree of cooperation along the same lines was obtained. Due to a number of conditions the work was not completed on the Mexican side on October 1 as was the case on the Texas side. However, there was a great deal of activity in the Lower Rio Grande Valley of Mexico as of October 1 and the work was practically concluded within a few days thereafter. On both sides of the International line, however, a condition exists which makes this program particularly burdensome on the farmers. The warm weather at that season of the year and the fertile soil causes any portion of any cotton root that is left buried beneath the surface of the ground to sprout immediately following even a light rain so that more than one working of a given field was required over large areas. The farmers cheerfully cooperated in this effort, however, and on the date of October 1 there were very few fields in which the recleaning had not been accomplished on the Texas side and it is believed there were no fields on which there was any standing cotton at such a stage of development as to afford favorable food for the pink bollworm.

The danger of spread by the movement of seed and lint by truck or similar means from the heavily infested section in the Big Bend Section of Texas is markedly greater than from the lightly infested sections. To prevent such movement road stations are operated in cooperation with the state on the important roads leaving the heavily infested section. Supervision of movement of seed and other cotton products by trucks is also a necessary part of operations in the Lower Rio Grande Valley of Texas.

In 1931 a very heavy infestation was found in wild cotton growing in parts of southern Florida and work was begun to remove this wild cotton which is of no commercial value. At the outset, the wild cotton most accessible to the average resident or tourist was removed first, gradually working back to more remote locations. It is believed that most of the wild cotton has been located. Experience, however, has shown that some of this cotton will sprout from portions of the roots which were not removed, and it also comes from seed, remaining in the soil. This necessitates going over the ground several times. Work on the removal and destruction of wild cotton can be done only during the drier seasons. Certain phases of the work of removal of wild cotton can be carried on as a part of the program for relief employment and by the use of CCC enrollees. As far as possible full use is made of assistance from these sources.

Now included under this appropriation item is the work formerly done under the separate item, "Thurberia Weevil Control", for the administration and enforcement of the Federal quarantine on account of the Thurberia Weevil. This quarantine regulates the movement of cotton and cotton products from the two counties in Arizona where this pest is known to occur. The work involves supervising and handling, treatment, and movement of cotton, cottonseed and other articles likely to carry the Thurberia weevil into uninfested regions. The Thurberia weevil is a native variety of the Mexican boll weevil and occurs in limited areas in the State of Arizona and parts of Mexico. Under natural conditions this native insect lives on wild Thurberia cotton. With the production of cultivated cotton in this area it has become attracted to this crop. The weevil has demonstrated capacity to breed in cultivated cotton and because of its ability to live under arid conditions is a serious menace to cotton grown under semi-arid conditions.

The expenditures for the enforcement of the quarantine are of a continuing nature and are the minimum required to meet conditions. The project for removal of *Thurberia* plants carried on in the infested area with emergency funds may reduce the possibilities of infestation in commercial cotton. The work done under this relief project will not, however, permit any immediate modifications in the quarantine requirements to safeguard the spread of the *Thurberia* weevil.

SUPPLEMENTAL FUNDS

Projects	Obligated 1939	Estimated obli- gations, 1940
<u>Emergency Relief Appropriation Act of 1938:</u>		
Locating and destroying <i>Thurberia</i> plants	\$20,075	- - - -
<u>Emergency Relief Appropriation Act of 1939:</u>		
Wild cotton eradication	- - - -	\$60,972
Locating and destroying <i>Thurberia</i> plants	- - - -	69,667
Total, Supplemental Funds	80,075	130,619

(r) PINK BOLLWORM CONTROL

(s) THURBERIA WEEVIL CONTROL

Appropriations under the above heads, carried as separate items in the Agricultural Act for 1940, have been consolidated in the 1941 Estimates under the title "Pink bollworm and *Thurberia* weevil control". The appropriations for 1940 are:

"Pink bollworm control"	\$906,800
" <i>Thurberia</i> weevil control"	2,808
	<u>909,608</u>

(t) WHITE-FRINGED BEETLE CONTROL

Appropriation Act, 1940.....	- - -
Budget Estimate, 1941.....	603,600
Increase.....	<u>603,600</u>

PROJECT STATEMENT

Projects	1941 (Estimated)	Increases
White-fringed beetle control.....	\$600,000	+\$600,000 (1)
Additional for administrative promotions.....	5,600	+ 5,600 (2)
Total appropriation.....	603,600	+ 603,600

INCREASES

(1) This is a new appropriation item in the basic amount of \$600,000 for the control and prevention of spread of white-fringed beetle. The white-fringed beetle, an insect native to South America and not previously known to occur in the United States, was first reported as occurring in the United States in the fall of 1936. Preliminary surveys conducted the following spring disclosed its presence in limited parts of northern Florida and Alabama, where it was causing material losses to certain important crops. The preliminary information showed that it attacks a wide variety of crops and demonstrated that it is a potential pest of major importance over a wide area. Because of the potential importance and the incipient nature of the infestation, an effort to combat the pest was actively begun in July 1937, the work being conducted in cooperation with State and local agencies and supported by funds allotted from special appropriations for "Control of incipient and emergency outbreaks of insect pests and plant diseases". Since the initial discovery, limited infestations of this insect have been found in other regions of Alabama and Florida and also in Mississippi and Louisiana. The cooperative effort to suppress and prevent the spread of this pest has continued and the funds allotted for the work from the special appropriations have aggregated \$982,940. It is anticipated that an additional allotment will be made to carry on the work during the last half of the fiscal year 1940.

The control program proposes to continue the intensive effort to eradicate the pest in all outlying areas of infestation; to drastically suppress the beetle population in other infested areas with ultimate eradication as the definite objective; and to enforce regulatory measures to prevent spread by artificial means. The pest is known to be established in relatively localized areas comprising a total of approximately 50,000 acres in the four States above mentioned. Wherever control and suppressive measures have been conducted there has been a drastic reduction of beetle population. Of the amount requested, approximately half would be expended for the personal services in the field of quarantine enforcement, supervision of control and eradication work, and field labor. The remainder of the appropriation is required for travel expenses, automotive equipment, chemicals, rentals, and miscellaneous expenses.

(2) \$5,600 additional is estimated for administrative promotions in accordance with the plan which is being uniformly applied in the Budget Estimates for 1941. While this is a new appropriation item, work has, as indicated above, been in operation for several years, and many employees have been in service since its inception.

WORK UNDER THIS APPROPRIATION

This new appropriation item is proposed to provide for continuing work directed towards the suppression and eradication of the white-fringed beetle. Since July 1937 the Bureau has been cooperating with State and local agencies in an effort to eradicate, suppress, and prevent the spread of this introduced pest, which has become established in limited areas in four States, the funds for control work conducted by the Bureau being supplied from various appropriations provided under the general authorization for the control of incipient and emergency outbreaks of insect pests and plant diseases. It is believed that the area occupied by this insect is now rather definitely, though not necessarily completely, determined. Federal and State quarantines have been promulgated and are being enforced to prevent the spread of the insect into new areas by natural

means. Definite progress has been made in these efforts. To bring the effort to a successful conclusion the operations will have to be continued for a number of years and conducted continuously throughout each fiscal year. These activities, therefore, become comparable with those being carried on against certain other plant pests, the work of which is provided for under separate appropriation items included in the regular estimates. It is believed the work for the control of this newly discovered pest should also be provided for under a regular appropriation item rather than under continued allotments of funds from special appropriations of the type above mentioned.

(u) BEE CULTURE

Appropriation Act, 1940.....	\$23,000
Budget Estimate, 1941.....	23,460
Increase.....	<u>460</u>

PROJECT STATEMENT

Projects	1939	1940 (Estimated)	1941 (Estimated)	Increase
Bee culture and apiary management.....	\$22,500	\$23,000	\$23,000	- -
Additional for administrative promotions.....	- -	- -	460	+ \$460 (1)
Unobligated balance.....	500	- -	- -	- -
Total appropriation.....	23,000	23,000	23,460	+ 460

INCREASE

(1) \$460 additional is estimated under this item for administrative promotions in accordance with the plan which is being uniformly applied in the Budget Estimates for 1941.

WORK UNDER THIS APPROPRIATION

This item provides for investigations on the habits and management of bees to make the production of honey and wax more profitable and to facilitate the pollination of fruits and vegetables and forage crops by the use of honeybees; and for the issuance of permits and inspections of adult honeybees imported into the United States under the Act of 1922 governing the importation of adult honeybees. This is the only specific appropriation made by the Federal Government which provides assistance or aid to the beekeeping interests in the United States, the annual value of which may be conservatively estimated at \$100,000,000. Only fourteen States carry on investigations in the field of bee culture and these activities are coordinated with those done under this appropriation. The states look to the Department to supply them the necessary information regarding the management of bees, control of their diseases, and satisfactory and effective handling of them in the pollination of plants and production of honey and wax.

Headquarters for the work carried on under this item are maintained at the laboratory at Beltsville, Md., where general investigations are conducted

as well as those concerned with problems affecting beekeeping in the Eastern States. Main field laboratories are located at Laramie, Wyo., Baton Rouge, La., and Davis, Calif., and a sublaboratory at Madison, Wis., to investigate problems peculiar to those regions and also study the effect of regional conditions on problems occurring throughout the United States. Investigations on certain special problems are also carried on in cooperation with state agencies in Arkansas, Iowa, and Texas. The activities under way are divided into seven work projects which are interrelated and studies on most of them are conducted at all of the field laboratories. Important phases of the work are discussed in the following paragraphs.

It is estimated that there are more than 200,000 beekeepers in the United States and that the number of colonies of bees is in excess of 4,000,000. Beekeepers and persons interested in the management of bees, the use and sale of honey and bee products, and the use of bees in the pollinization of plants are continuously seeking information on problems pertaining to bee culture. An important activity under this item consists of making available information on all phases of bee culture and serving the industry by diagnosing causes for death of bees especially the nature of diseases which are the most frequent source of losses. To make available information secured as a result of investigations cooperative relations are maintained with the beekeeping industry, extension agencies, etc., in an effort to enable beekeepers and those interested to put into practice the best methods of handling bees and the products that they produce. Information is also disseminated through Government publications, press notices, articles in outside publications, radio talks, talks before gatherings, by the use of motion pictures, film scripts and by supplying bibliographical references and answering correspondence. Samples of combs and bees submitted for diagnosis are examined in the laboratory to determine the nature of the disease that may be present. The correspondent is advised and given information which will aid him to combat the disease. These activities are carried on very largely through the Divisional headquarters maintained at Beltsville.

The honeybee is known to be affected by a number of different diseases. Some of these affect only the adult while others affect the immature stages. The most important disease is known as American foulbrood. This disease occurs throughout the United States and many of the states carry on inspections and other regulatory measures of combating it. Notwithstanding the efforts and the regulatory work done by the states the disease is still far from being effectively controlled. It is estimated that the annual losses from it through colonies alone approximate \$250,000. Investigations of this and other diseases are being carried on to determine more information about the disease and develop methods of treatment or prevention better than those now known. Part of these studies include investigations designed to develop strains of bees tolerant or resistant to American foulbrood. Experience has shown that this method is an effective way to reduce the losses caused by the European foulbrood, another important disease. Investigations on the diseases of bees are carried on at all laboratories and certain phases of the studies are conducted in cooperation with State Experiment Stations at Iowa, Wisconsin, Wyoming, Texas, and Arkansas.

The Honeybee Inspection Act of 1923 prohibits the importation of adult honeybees except from countries where the Secretary of Agriculture shall have determined that dangerous diseases of honeybees do not exist. When this has been determined the importation is made under regulations issued jointly by the

Department of Agriculture and the Treasury Department. When the importation is authorized it is restricted to adult queen bees and attendant workers. As a condition of entry the queen bees are examined to determine the presence or absence of the causative organism of disease of the adult bee. If inspection shows dangerous diseases are not present the queen bee is forwarded to destination but accompanied by workers produced in this country and known to be free from disease. The issuance of permits and performing the inspections required under this Act are two of the activities carried on under this appropriation.

There are many varieties and strains of honeybees. Experience and observation have shown that these differ greatly in their usefulness and ability to resist disease. Different methods should also be used in handling some of the strains. Investigations are under way to develop methods of breeding bees under controlled conditions and to determine hereditary characteristics with the idea of developing varieties and strains more resistant to cold, with greater ability to gather honey, that will be more useful in gathering and distributing pollen, that will have greater resistance to diseases, as well as characteristics which make them more amenable to management. These investigations are carried on in the laboratory and are supplemented by field studies to isolate distinctive strains and varieties of bees. These activities are carried on at Baton Rouge, Louisiana and Beltsville, Maryland, and in cooperation with certain state agencies.

The effective management of bees for the production of honey, wax, package bees or any other bee product depends on a knowledge of the natural behavior of the bees and the factors determining behavior. With a knowledge of these factors the beekeeper can often supply conditions necessary to handle the bees in a manner most satisfactory for his purpose. Investigations are under way to develop methods of apiary management which will result in the most effective use of bee colonies in the production of honey, wax, package bees, queen bees, propolis and bee venom. Investigations are carried on under laboratory conditions to determine the reaction of the bees to natural and artificial stimuli and to determine ways of utilizing this information in a practical manner. These studies are carried on in all of the field laboratories. Certain phases of these studies are conducted in cooperation with Experiment Stations in Louisiana, Oregon, California, Wyoming, and Wisconsin. Other phases of the studies are carried on in cooperation with various agencies in the Department.

The interrelation between bees and flowers and the effects that various kinds of nectar and pollen have on bees are not clearly understood. In those regions where the honey crop comes from mixed flora the beekeeper has little idea as to the source of his product. Information of this nature is of practical value in choosing apiary sites, determining ways of grading and marking honey and in preparing bees for overwintering or for brood-rearing purposes. Investigations are under way to determine various kinds of plants of most value to the beekeeper in producing honey, and to ascertain their blooming dates in various locations where they occur. Information of this nature is of particular importance to beekeepers. Studies are also under way to determine the conditions affecting the secretion of nectar, yields of pollen and their relation to the management of bees. An effort is being made to determine the amount of winter pollen stores necessary to insure optimum colony development in the spring. Studies are under way to determine methods of overcoming pollen deficiencies and to determine conditions under which bees can be most effectively used in the pollination of plants which produce important agricultural

crops. Investigations of these natures are carried on at the various field stations; special studies are under way in cooperation with the Oregon Agricultural Experiment Station and the University of California.

Bee products are used in a wide variety of ways--in industry, in the household, and even in the sickroom. Beeswax is used extensively in cosmetics, dental supplies, wax for candles and has extensive use in the preparation of foundation comb for the apiary. This product varies considerably and there is no uniform method by which it can be turned out or its quality standardized. The absence of a standardizing quality of wax affects materially the prices that are received and limits at least to some extent the more extensive use of this material. Studies are under way to determine methods of standardizing the quality of wax with the hope that standard grades can be established along the same general lines as have already been worked out by the Department for honey. The shipping of package bees has become an important part of the bee-keeping industry. Through investigations conducted by the Bureau recommendations have been made for the standardization of the shipping cage and advice has been given as to methods of shipment which will aid in reducing the losses caused in transit. Available information as to the standardization of methods of packing, shipping, and utilization of package bees does not, however, eliminate losses that may occur in transit or explain why the bees do not become established in new regions. Investigations are being carried out in this field which have a very direct relation to the problem frequently referred to by the beekeeper under the general term "supersedure." Investigations on the preparation, handling, and packaging of bee products for the market are carried on as a part of the activities at the various stations. The special emphasis that is now being placed on wax is carried on at the laboratory now located at Davis and in cooperation with the University of California.

(v) INSECTS AFFECTING MAN AND ANIMALS

Appropriation Act, 1940.....	\$131,500
Budget Estimate, 1941.....	<u>132,540</u>
Increase.....	<u><u>1,040</u></u>

PROJECT STATEMENT

Projects	1939	1940 (Estimated)	1941 (Estimated)	Increase
1. Investigations on insects affecting man.....	\$66,496:	\$63,573 :	\$63,573 :	---
2. Investigations on household insects.....	14,403:	14,475 :	14,475 :	---
3. Investigations on insects affecting animals.....	108,537:	103,452 :	103,452 :	---
Additional for administrative promotions.....	---	---	1,040 :	+\$1,040 (1)
Unobligated balance.....	1,609:	---	---	---
Total appropriation.....	\$191,100:	\$131,500 :	\$132,540 :	+\$1,040

INCREASE

(1) \$1,040 additional is estimated under this item for administrative promotions in accordance with the plan which is being uniformly applied in the Budget Estimates for 1941.

WORK UNDER THIS APPROPRIATION

General.---This item provides for investigations on insect pests attacking man or injuring him by carrying diseases, including those insect pests which annoy him in his habitation or destroy household supplies, fabrics, etc. It also provides for investigations on insect pests of farm and range animals, poultry, birds, and wild birds and animals and the development of methods for their control or eradication. Activities are carried on independently or in cooperation with the Public Health Service, Bureau of Animal Industry, and Bureau of Biological Survey. The Bureau of Entomology and Plant Quarantine is, however, responsible for the investigations on insects.

Work under this appropriation is carried on under three financial projects, which are briefly discussed as follows:

1. Investigations on insects affecting man.--Mosquitoes as a class are the most important insect pests known to man. They are responsible for carrying such dreaded diseases as yellow fever, malaria fever, dengue fever, etc. There are many different kinds of mosquitoes and no one control measure is equally effective for all kinds. The habits of some of the commoner forms are fairly well known and means of control have been developed. The habits of many kinds are known only in a general way and effective controls are not available. Even with the commoner forms, methods of control depend on various local conditions. The planning for control campaigns requires technical assistance and at present the requests for advice can only be partially met. The studies under way are conducted from Portland, Oregon, New Smyrna, Florida, and Orlando, Florida. Those in the Northwest are concerned largely with forms in flood water and those in Florida with salt marsh forms, although in Florida attention is also being given to the group of mosquitoes which obtains its air through plants rather than coming to the surface of the water. Salt marsh mosquitoes are responsible for heavy losses to agriculture, fishing and industrial activities and especially in retarding the development of resorting areas on the Atlantic and Gulf coasts. Large sums are being spent in attempts to control these pests and the development of more effective control measures and measures which will not adversely affect wildlife is important.

Sand flies are not definitely known to carry diseases. They are, however, of prime importance to man in certain sections of the country, particularly along the southeast seaboard. Investigations under way are headquartered at St. Lucie, Florida. The habits of only a comparatively few species of sand flies are known and until recently no effective control measures were available. It is, however, now possible to suggest control measures that will materially reduce the numbers of certain species. The value of these methods should be further tested especially with reference to the effect of pumping out diked areas, and ways devised to combat those breeding in holes in trees and along streams.

Eye gnats are extremely annoying to man and livestock and also transmit a dangerous eye disease which is especially common among children of school age. These pests are particularly troublesome in parts of the Southern States, and surveys are being conducted there, as well as in the winter garden area of Texas, to determine their distribution and factors favoring breeding. Reduced appropriations for this fiscal year have made necessary the discontinuance of this work project on September 1.

The development of safe and economical methods of rearing and transplanting sterile maggots for surgical use has been investigated. Certain materials, namely allantoin and urea, found in the excretions of blowfly maggots have been shown by these investigations to have a beneficial effect on suppurating wounds and other disease conditions. While the presence of some species of fly larvae is beneficial to wounds, other species are very destructive to live tissues and the differences in the structures and secretions of these various types are being studied.

Certain ticks, including the common dog tick, transmit the deadly Rocky Mountain spotted fever of man. Studies are under way to determine the habits of these and other kinds of ticks so as to determine facts which

may aid in developing methods for their control. Investigations on dog ticks in New England in the vicinity of Martha's Vineyard, which were begun in the fiscal year 1938, are being continued with a view to the development of effective control measures.

Work has been started with funds appropriated in the 1939 act on gnat investigations in the vicinity of Clear Lake, California, where a particularly troublesome situation exists.

2. Investigations on household insects.---This project provides for investigations of insect pests in dwellings, hotels, etc., those annoying householders, and those destroying household supplies, drugs, fabrics, etc., and the development of methods for their control. There are many kinds of insects which annoy man or destroy his household possessions. The habits of these differ greatly. The habits of the same species may even differ under various conditions of artificial environment. The development of control measures is complicated because of the wide variety of conditions under which the pests occur. Special attention is now being given to the development of more effective methods of control by fumigation, the use of safe fumigants, and the determination of conditions under which various fumigant materials may be used. These studies also involve determining the effect proposed controls may have on projects in storage, households, stores, etc. Investigations of various chemicals for the mothproofing of various materials are also under way.

3. Investigations on insects affecting animals.---This project provides for investigations on insects injurious to horses, cattle, sheep, goats, swine, and other domestic animals, and the development of methods for their control.

Screechworms are pests of cattle, sheep, goats, and various other animals, causing immense losses, particularly under range conditions. The studies conducted with allotments from regular funds are carried on at field laboratories in Texas. About 90% of the screechworm infestations are caused by the species rather recently differentiated, which restricts its breeding to live animals. The habits of this species are different than thought for the composite species, and more detailed studies are necessary to the development of fully effective controls. The work in Texas involves the handling of some 800 head of livestock in experimental work under ranch conditions. At this ranch station tests of more than 500 chemicals as wound protectors have been carried out, and a new insecticide which shows much promise has been discovered and is now being tried under practical ranch conditions.

The larvae of certain flies, commonly known as cattle grubs, not only greatly injure hides but materially interfere with the effective management of dairy and range cattle. The annual losses from these insects are estimated as high as \$50,000,000. Studies of methods for controlling these pests are under way.

Horse bots cause serious injury to horses and related animals and also greatly reduce their efficiency. Since fairly effective methods of control have been developed and reduced appropriations make it necessary to effect savings, the work on horse bots is to be discontinued on September 1 and the Ames, Iowa, laboratory is being closed.

The sheep head bot materially lowers the vitality of the infested animal and in many cases causes its death. Goat lice do a great amount of injury to the mohair, and also reduce the vitality of the animals. The losses caused by these pests to sheep and goat raisers are great, and there is an insistent demand for effective control measures. Experiments to determine the value of certain volatile materials against head bots and sulphur for the control of lice are under way, but the effect of these possible treatments on the animals and insects needs further study.

Many of the fly sprays now used on farms to protect livestock, particularly dairy cattle, are valueless, and some of them are even detrimental to cattle and dairy and other food products. Investigations are now under way to develop a more effective and cheaper spray. If successful, this work will be of material aid to the livestock and dairy industry, and besides controlling flies will tend to reduce the opportunity for disease.

A number of species of ticks are detrimental to animals. Wounds caused by some ticks, such as the Gulf Coast tick, provide entrance places for screw worms, which often destroy the ears and sometimes cause the death of the animals. Information on the distribution and habits of these species is not well known and no satisfactory control measures are available for several important species.

(w) INSECT-PEST SURVEY AND IDENTIFICATION

Appropriation Act, 1940.....	\$154,790
Budget Estimate, 1941.....	155,730
Increase.....	<u>940</u>

PROJECT STATEMENT

Projects	1939	1940 (Estimated)	1941 (Estimated)	Increase
1. Insect pest survey..	\$19,555	\$19,559	\$19,559	- -
2. Identification and classification of insects.....	130,191	135,231	135,231	- -
Additional for adminis- trative promotions.....	- -	- -	940	+ \$940 (1)
Unobligated balance....	44	- -	- -	- -
Total appropriation..	149,790	154,790	155,730	+ 940

INCREASE

(1) \$940 additional is estimated under this item for administrative promotions in accordance with the plan which is being uniformly applied in the Budget Estimates for 1941.

WORK UNDER THIS APPROPRIATION

General.---The research carried on under this item is essential to the various activities of the Bureau and involves identification of specimens and securing and recording of facts regarding the distribution and abundance of economic insect pests. It is divided into two financial projects, which are briefly discussed as follows:

1. Insect pest survey.---The activities under this project are concerned with: (a) collecting, recording, analyzing, and maintaining permanent records on insect abundance and damage; (b) maintaining of records of the occurrence and distribution of insect pests in foreign countries, information necessary in connection with the enforcement of quarantines regulating the entry of plants and plant products; (c) publication of a monthly bulletin on current insect conditions and an annual summary of the conditions which occur throughout the United States.

Information on insect conditions throughout the country is supplied through cooperative arrangements with entomologists of the Bureau and state entomological agencies. These cooperators furnish notes on the occurrence and relative abundance of insect pests in their respective regions. The assembling and redistribution of current information on insect conditions is of importance to the Bureau but is also useful to state workers in forewarning them of menacing insect conditions occurring in neighboring areas.

2. Identification and classification of insects.--The work under this project is of a continuing and service nature of vital importance to economic entomology. It includes the identification, classification, and description of insects in both the adult and immature stages. Accurate and authoritative information on the identity and relationships of insects is required in the daily work concerned with research on insects, with control activities, and with the enforcement of plant and animal quarantines. Without this information it would be impossible to conduct many of these activities in an effective manner. The prompt recognition of the numerous insect pests is essential, and can only be done by specialists. The work done under this project plays an important part in the economic work on insect pests carried on by other governmental agencies, state agricultural colleges and experiment stations, universities, etc., in this country and elsewhere. In connection with these activities, investigations are also carried out on the anatomy and structure of insects. The proper understanding of the characters by which the hundreds of thousands of kinds may be distinguished is essential.

(x) FOREIGN PARASITES

Appropriation Act, 1940.....	\$38,000
Budget Estimate, 1941.....	38,100
Increase.....	<u>100</u>

PROJECT STATEMENT

Projects	1939	1940	1941	Increase
		:(Estimated):	:(Estimated):	
Foreign parasite introduction.....	\$37,794	\$38,000	\$38,000	- -
Additional for administrative				
promotions.....	- -	- -	100	+ \$100 (1)
Unobligated balance.....	206	- -	- -	- -
Total appropriation.....	38,000	38,000	38,100	+ 100

INCREASE

(1) \$100 additional is estimated under this item for administrative promotions in accordance with the plan which is being uniformly applied in the Budget Estimates for 1941.

WORK UNDER THIS APPROPRIATION

This appropriation provides for administrative expenses connected with the introduction of natural enemies of injurious insects and related pests and for the exchange with other countries of useful and beneficial insects. This includes operating expenses of a laboratory in the United States which serves as a receiving center for the natural enemies imported from foreign countries and for the expenses of maintenance and operation of field laboratories in foreign countries which serve as a center for exploration to locate useful, beneficial insects and activities associated with assembling them for shipment to the United States.

The value of natural enemies as aids in controlling injurious insect pests has been amply demonstrated by work done over a period of many years. The use of natural enemies as possible aids in combating insect pests is a definite part of investigations to develop means for the control of injurious forms, particularly those which are not native to the section where they cause damage. Many of the major insect pests of the United States were introduced with the early development of agriculture. Except in a few instances, their natural enemies did not accompany the introductions. Studies of their natural enemies and their native habitat, and the collecting and assembling of them for shipment to the United States requires especially trained personnel and many contacts with the appropriate officials in foreign countries. To do this it is necessary to maintain laboratories with appropriate facilities in foreign countries. There are two such field laboratories, one in Europe and the other in Japan. War conditions have necessitated the recall of the personnel from Europe, and for the present it is planned to use them in South America, where studies are badly needed and in the parasite introduction work in the United States. It is necessary that appropriate facilities and trained personnel be available in the United States to receive shipments of natural enemies and hold them under quarantine conditions to assure the absence of injurious insects before they are released in the United States. The insects for which natural enemies may be sought attack a wide variety of crops. The expenses connected with the importation of parasites other than those of a recurring and administrative nature are provided for from the appropriations made for studies on the particular pest.

(y) CONTROL INVESTIGATIONS

Appropriation Act, 1940.....	\$67,518
Budget Estimate, 1941.....	<u>67,778</u>
Increase.....	<u>260</u>

PROJECT STATEMENT

Projects	1939	1940 (Estimated)	1941 (Estimated)	Increase
Control investigations.....	\$72,243	\$67,518	\$67,518	---
Additional for administrative promotions.....	---	---	260	+\$260 (1)
Unobligated balance.....	275	---	---	---
Total appropriation.....	72,518	67,518	67,778	+ 260

INCREASE

(1) \$260 additional is estimated under this item for administrative promotions in accordance with the plan which is being uniformly applied in the Budget Estimates for 1941.

WORK UNDER THIS APPROPRIATION

This appropriation provides for investigations to develop new materials which may be useful for the control of insect pests; for research concerned with the commercial application of methods developed for the sterilization or disinfection of plants or plant products; for the coordination and standardization of methods of disinfection of articles or products the movement of which is regulated by various plant quarantines. These studies have an intimate relation to much of the research, control, and quarantine enforcement work of the Bureau and may cut across crop and divisional lines. In such cases the work is cooperative and closely coordinated with that done by other units. These activities include technical studies to discover or develop insecticides and to obtain new and needed information on the action of insecticides, repellents, and attractants. An important phase of the work is testing new materials that may be developed as the result of chemical studies to determine their toxicity under laboratory conditions on certain standard test insects and plants. This testing of materials on insects goes hand in hand with investigations on the chemistry of insecticides and forms the basis for suggestions for new materials or methods that may be useful against particular crop pests. Those which promise to be of value are given further testing at field laboratories concerned with the control of insects for which they may be applicable. The basic information secured is applicable to many other lines of work on insect control. The activities concerned with sterilization or disinfection of quarantined articles include investigations to develop

methods by fumigation, the use of heat and other means, which will permit freer movement of the regulated articles without endangering the spread of pests.

The various lines of investigation have many related aspects and are grouped under one project. The more important activities now under way are discussed briefly in the following paragraphs:

Investigations to determine the application, under varying conditions, of gaseous insecticides in the destruction of insects of economic importance are concerned primarily with methods of commercially applying fumigants for the treatment of products covered by quarantine regulations. These studies aim to develop treatments by fumigation which will make it possible to treat products, the movement of which is now prohibited or restricted by quarantines so they can be imported or moved interstate without accompanying risk of spreading infestations of insects which are the subject of quarantine.

Certain insect pests which may occur in many of the products regulated by quarantine can be killed by heat or by exposure to low temperatures, and these method of sterilizing plants and plant products are used in connection with certain Federal quarantines. The commercial application of these methods requires constant technical supervision. An important part of the work carried on under the project consists in furnishing this type of service to the unit responsible for the enforcement of the quarantine. Certain pests not regulated by quarantine may be controlled by heat or by refrigeration. Experiments to determine the effect of high and low temperatures on insects and especially those forms which may be moved in connection with commercial shipments are carried on in cooperation with other divisions of the Bureau.

New insecticides frequently require the development of new methods for applying them. Studies on the development of machinery and equipment for applying insecticides are a part of the activities which come under this project. At present attention is being given to modifying present equipment and developing new equipment for applying insecticides in control operations against certain major pests such as the gypsy moth. These and related studies are carried on in cooperation with other divisions of the Bureau.

An important phase of the work under this project consists of testing new materials supposed to have insecticidal properties to determine their effect on insects. New materials developed by the chemists are tested under laboratory conditions on various types of insects and plants as a preliminary determination of the insecticidal value of the compounds. The materials tested include not only those synthesized by chemists but also preparations of various plants thought to contain compounds of insecticidal value. Ten or fifteen kinds of insects which can be reared in large numbers throughout the year are used in these tests. In addition to testing compounds developed by the chemists, these laboratory tests are intimately associated with the development of strains or varieties of plants which are the source of insecticidal compounds. The breeding and selection work of the Bureau of Plant Industry, in developing strains or varieties of plants such as Cracca virginiana, a native plant known as devil's shoestring, and pyrethrum in an

endeavor to obtain strains with a higher insecticidal content, is dependent on these laboratory tests on insects to determine the relative insecticide content of the individual plants. The work begun in previous years along this line has been continued.

A thorough knowledge of the normal physiology of insects is a necessary basis for studies to determine the effect that various kinds of poisons may have on the insect. Physiological studies and investigations on insects are a part of the activities carried on under the project and involve studies to determine the relation of insects to external and internal environmental factors. These serve as a basis for determining the lethal action under abnormal conditions such as temperatures, poisons, etc.

Studies to determine the toxic effect of insecticides on insects include a group of related problems considered under this project. The object of studies of this nature is to determine the effect on insects of various compounds and to ascertain the lethal dosage of insecticides under varying conditions of temperature and humidity.

Tobacco has long been recognized as one of the standard insecticides. Studies are now under way to determine the possibility of using various forms of insecticides made from tobacco as stomach poisons as well as contact poisons. These activities are carried on in cooperation with the chemists and include not only studies on tobacco extracts themselves, but also the possibility of mixing them in a more effective manner with other materials which would serve as carriers.

(2) INSECTICIDE AND FUNGICIDE INVESTIGATIONS

Appropriation Act, 1940.....	\$134,984
Budget Estimate, 1940.....	136,174
Increase.....	1,190

PROJECT STATEMENT

Projects	1939	1940 (Estimated)	1941 (Estimated)	Increase
Chemical investigations on insecticides.....	\$122,990	\$134,984	\$134,984	---
Additional for administrative promotions.....	---	---	1,190	+\$1,190 (1)
Unobligated balance.....	994	---	---	---
Total appropriation..	123,984	134,984	136,174	+ 1,190

INCREASE

(1) \$1,190 additional is estimated under this item for administrative promotions in accordance with the plan which is being uniformly applied in the Budget Estimates for 1941.

WORK UNDER THIS APPROPRIATION

This appropriation provides for investigations to develop better and cheaper materials for destroying injurious insects and fungi; for the development of methods of manufacturing these materials; for investigation of chemical and physical properties of such materials; and for the study of chemical problems relating to composition action, and application of insecticides and fungicides. The several activities are briefly discussed in the following paragraphs:

This project provides for investigation to develop insecticidal materials for the control of insect pests and for the development of effective attractants or repellents which may be used to aid in combating insects. Particular attention is directed to insecticides which are less hazardous to users and less poisonous to anyone eating sprayed or dusted fruits and vegetables. The improvement of existing insecticides by detailed study of their physical and chemical properties is also under way. Investigations to originate and improve methods of analyzing insecticides and to devise cheaper methods of manufacture are activities which come under this project. The determination of the most effective chemical means of removing harmful spray residues from fruits and vegetables that have been treated with compounds containing arsenic, lead, copper, fluorine, or other insecticidal and fungicidal materials is also an important phase of the work. The studies under way are included under a number of work projects referred to in the following paragraphs:

Some of the most useful insecticides--for example, pyrethrum, nicotine, derris, and cube--are natural products of plant life. It is believed that there are many other plants which have insecticidal properties of value. The activities under this work project aim to discover such plants, study the constituents to which the toxicity is due, and to develop useful insecticidal preparations of known merit. Special attention is being given to derris, cube, tobacco, and pyrethrum. An effort is being made to find ways of preventing the decomposition of the effective insecticidal constituents of extracts of derris and cube and to study the relationship between the active principles, such as rotenone and deguelin. Study is being made of certain native plants to determine those which contain considerable quantities of insecticidally active ingredients.

Investigations are under way to develop organic compounds which have insecticidal properties but leave residues relatively non-injurious to warm-blooded animals or man. Hundreds of organic compounds have been obtained or synthesized. Special attention is being given to methods of using phenothiazine, diphenylamine, and a few other compounds that have shown particular promise.

Investigations of various chemical problems connected with the removal of spray residues are closely coordinated with investigations carried on in other units of the Bureau and in the Bureau of Plant Industry. Continued effort is being made to develop better chemical methods for removing objectionable residues. Analyses are made to determine the amounts of residues resulting from various spray formulae. Work includes not only studies on apples but also studies on other food crops, such as peaches, grapes, cherries, berries, and cabbage. In addition to determining the residues of lead, arsenic, and fluorine which result from the use of insecticides such as the arsenicals and cryolite, attention is also being given to the determination of residues from the use of organic compounds such as derris, nicotine, and phenothiazine.

Studies on inorganic insecticides are directed to the improvement of common inorganic insecticides and the development of possible new combinations which have desirable characteristics. By far the larger quantity of insecticides used are of inorganic origin. Some of these are effective against the insect but are more or less injurious to the foliage. The behavior of these materials is sometimes variable and insecticidal properties may be improved and modification made in their manufacture. Other materials may be developed by improving their physical properties. Calcium arsenate and sodium arsenite are being intensively studied to determine the basic facts governing their usefulness as insecticides.

Chemical investigations on fumigants aim to develop new methods of well-known chemical compounds for fumigation of growing material or stored products, to increase their efficiency, and reduce the cost of operation. It is also aimed to find new compounds which may be used as fumigants and to determine the correlation between their chemical constitution and toxicity to various insect pests. These activities are closely correlated with those of other units in the Bureau. Special attention is being given to fumigants that may be effectively used for the control of the resistant form of the California red scale of citrus and to the chemical phases of work on fumigants for use in mills and milling machinery.

The application of insecticides frequently requires the use of other substances not primarily active. Studies are under way to determine the composition, characteristics, and uses of a large class of materials which in themselves have no insecticidal properties but are used in conjunction with insecticides to improve their application. Materials of this class include the inert powders added to improve the distribution of insecticidal dusts and the substances used to increase the wetting, spreading, penetrating, and adhesive properties of sprays. As a part of this activity a study is being made of stabilizers to protect various materials from the effect that weather conditions may have on their toxicity. A wide variety of products is studied in connection with these activities.

Goldfish respond readily to many poisons. They can be maintained throughout the year in the laboratory and are readily available as test animals. By using them in initial tests, studies to develop new plant materials and organic compounds which may be used as insecticides are expedited.

Goldfish are now used largely to obtain information on the question of the correlation between toxicity and the chemical composition of organic compounds, those most recently studied including the isomers formed by the substitution of the hydrogens of phenol with the halogens and the nitro group.

In carrying on both the investigational and control activities of the Bureau there is need to have many materials analyzed so their constituents will be known. The chemical activities of this type are primarily of a service nature but include the analyzing of samples of miscellaneous insecticidal materials to determine whether they meet specifications and the determination of the constituents of materials tested by various laboratories of the Bureau, and hence usually have a definite bearing on research.

(aa) TRANSIT INSPECTION

Appropriation Act, 1940.....	\$44,059
Budget Estimate, 1941.....	44,559
Increase.....	<u>500</u>

PROJECT STATEMENT

Projects	1939	1940 (Estimated)	1941 (Estimated)	Increase
Transit inspection.....	\$43,290	\$44,059	\$44,059	---
Additional for administrative promotions.....	---	---	500	+ \$500 (1)
Unobligated balance.....	769	---	---	---
Total appropriation.....	44,059	44,059	44,559	+ 500

INCREASE

(1) \$500 additional is estimated under this item for administrative promotions in accordance with the plan which is being uniformly applied in the Budget Estimates for 1941.

WORK UNDER THIS APPROPRIATION

This appropriation provides for the inspection in transit of articles regulated by plant quarantines to determine if they are being transported in violation of such quarantines. The only means by which the Department can be assured that safeguards required under plant quarantine regulations are being followed in the case of mail, express, and freight shipments is to maintain a system of inspecting these products while in transit. This work consists of checking such shipments at important railway centers and transfer points to intercept articles which may be moving in violation of the quarantines. The prompt discovery of any weakness in inspection or certification makes it possible to correct faults or add necessary safeguards for the prevention of the establishment of pests at points far removed from the infested area. Experience has shown that when the Department fails to check shipments at railroad centers and transfer points uninspected, untreated, or uncertified products, which may be infested, are transported by common carriers into uninfested areas and thus threaten the establishment of these pests in such areas. The transit inspection service not only turns back several thousand packages every year, but it also serves to keep the employees of common carriers informed of quarantine requirements and thus obtains their active support in cooperating with the Department in its enforcement of Federal quarantines. The value of this work is indicated by a steady decrease in the ratio of violations to shipments.

(bb) FOREIGN PLANT QUARANTINES

Appropriation Act, 1940.....	\$680,000
Budget Estimate, 1941.....	683,080
Increase.....	<u>3,080</u>

PROJECT STATEMENT

Projects	1939	1940 (Estimated)	1941 (Estimated)	Increase
1. Import and permit service for issuance of permits for the importation of plants and plant products to comply with plant quarantines.....	\$57,055	\$58,348	\$58,348	---
2. Inspection at ports of entry of plants and plant products regulated by plant quarantines..	605,715	621,652	621,652	---
Additional for administrative promotions.....	---	---	3,080	+\$3,080 (1)
Unobligated balance.....	17,230	---	---	---
Total appropriation.....	680,000	680,000	683,080	+ 3,080

INCREASE

(1) \$3,080 additional is estimated under this item for administrative promotions in accordance with the plan which is being uniformly applied in the Budget Estimates for 1941.

WORK UNDER THIS APPROPRIATION

This appropriation provides for administering various quarantines and regulatory orders to prevent the entry into the United States from foreign countries, Puerto Rico and Hawaii of injurious insects and plant diseases by controlling and safeguarding the entry of plants and plant products. These activities include the enforcement of (1) foreign plant quarantines and regulatory orders issued under the Plant Quarantine Act of 1912, as amended; (2) rules and regulations governing the entry into the United States of railway cars and other vehicles, etc., from Mexico; (3) the Act of 1905 governing the importation of living insects into the United States; and (4) regulations governing the shipment of plants and plant products to the mainland from Hawaii and Puerto Rico. The operations divide into two groups. One is concerned with authorizing the importation of plants and plant products which may enter the United States under the quarantines and regulatory orders. The other deals with inspections at ports of entry to detect and exclude dangerous plant pests and to see that plant material imported under permit meets the requirements of the authorization. The second group includes the fumigation of freight cars entering the United States from Mexico. A charge is made of \$4 per car, resulting in Treasury receipts of \$16,340 during the fiscal year 1939.

1. Import and permit service for issuance of permits for the importation of plants and plant products to comply with plant quarantines.--This project provides for the issuing of permits authorizing the entry of plants and plant products which can be imported without introducing dangerous plant pests. It is necessary to limit the entry of plants and plant products to those which represent the least pest risk or to those which may be adequately safeguarded. Notices of arrival which are required for all imported entries under regulation provide a record of volume, nature of materials, destination and point of origin. Material arriving under permits issued in advance is inspected at the port of entry or port of first arrival to determine that the requirements have been fulfilled. These inspections and, if necessary, disinfection or rejection, take place usually at the port of entry, except in the case of nursery stock which is inspected at certain designated points where facilities exist for the care of living plants during their inspection. The issuance of permits requires a large amount of correspondence and making and maintaining records. The work is done for the greater part in Washington.

2. Inspection at ports of entry of plants and plant products regulated by plant quarantines.--This project provides for the inspection of plants and plant products at ports of entry or first arrival to protect the United States from injurious insects and plant diseases. This includes inspection work at the principal maritime ports of entry or first arrival on the mainland and in Puerto Rico and Hawaii, and on the Mexican and Canadian borders. It also provides for the inspection of plants and plant products entering and leaving the District of Columbia to meet the requirements of District of Columbia and State regulations, and the sanitary inspection and certification in Puerto Rico and Hawaii of fruits and vegetables offered for shipment to the mainland. The various activities involve (1) the inspection of ships, air crafts, railway cars, automobiles, and other vehicles, mail packages, passengers' baggage, ships' stores, and the belongings of travelers entering the United States; (2) the inspection of materials entered under permits; (3) the inspection of certain classes of plants in the field, following an initial inspection at ports of entry to assure absence of diseases or pests which cannot be detected by inspection at the time of entry; (4) the inspection of plant introduction gardens maintained by the Bureau of Plant Industry; (5) the supervision of treatments of plants, plant products, or other articles which may be required as a condition of entry; and other activities necessary to carry out the purpose of the project.

(cc) CERTIFICATION OF EXPORTS

Appropriation Act, 1940..... \$31,862
 Budget Estimate, 1941..... 31,862

PROJECT STATEMENT

Projects	1939	1940 (Estimated)	1941 (Estimated)
Certification of exports.....	\$30,636	\$31,862	\$31,862
Unobligated balance.....	1,196	---	---
Total appropriation.....	31,832	31,862	31,862

WORK UNDER THIS APPROPRIATION

This item provides for inspection and certification of fruit or other plant products to meet the sanitary requirements of the countries to which it is intended the products will be shipped. The inspection made is that necessary to issue the certificate required by the country of destination as a condition of entry. The work is carried on at various ports from which the products may be shipped. It is a service to American exporters, for which a nominal fee is charged. This fee is, however, not sufficient to make the project self-supporting. Ninety-one foreign countries now are requiring inspection and certification with respect to the presence of insects and plant diseases on fruit or other plant products imported from the United States. The American exporter is required to furnish a certificate indicating freedom from dangerous insect pests and plant diseases. If American growers are to maintain their markets in foreign countries having these requirements, it is necessary that all such shipments be carefully inspected. A charge of \$1 is made for each certificate issued, resulting in Treasury receipts of \$9,279 for the fiscal year 1939.

(dd) CONTROL OF EMERGENCY OUTBREAKS OF INSECT PESTS
AND PLANT DISEASES

During the fiscal years 1939 and 1940 appropriations aggregating \$5,450,000 were made available as follows:

Second Deficiency Act, 1938, approved June 25, 1938...\$ 700,000
 First Deficiency Act, 1939, approved March 15, 1939...3,000,000
 Public Resolution No. 22, approved June 13, 1939.....1,750,000

Of the amount available, \$3,566,800 was obligated during the fiscal year 1939, leaving a balance of \$1,883,200 available for obligation during the fiscal year 1940, of which, by legal limitation, only \$400,000 is available after January 1, 1940.

The Budget for 1941 includes no request for an appropriation under this item. It is expected, however, that an estimate of funds required to carry out the purpose of the authorizing legislation for the season of 1940 will be submitted for consideration in connection with funds provided by the Deficiency Appropriation Act. It is generally recognized that information that may be assembled regarding the status of plant pests which may occur in emergency outbreaks, such as grasshoppers, Mormon crickets, chinch bugs, the white-fringed beetle, etc., during the season when they are active gives a reasonably satisfactory basis on which an estimate of funds may be made. Such information is not available until late in the fall and considerably after the time when regular estimates are prepared. It is also recognized that plans and operations for the control of incipient and emergency outbreaks of plant pests have to be made and carried out on the basis of crop rather than fiscal years. For effective work, funds that are provided should, therefore, be available early in the calendar year.

CHANGE IN LANGUAGE

It is recommended that the language referring to this item be eliminated from the regular estimates providing appropriations for the fiscal year 1941. The purpose of the language included in the current Act was to provide authority to use during the last half of the current fiscal year not to exceed \$400,000 of the funds appropriated for these purposes by the First Deficiency Act, fiscal year 1939. This language has served this purpose and would not be applicable for inclusion in the appropriation act for the fiscal year 1941.

WORK UNDER THIS APPROPRIATION

Work under this appropriation is conducted on the basis of a crop season rather than a fiscal year. It is therefore not practicable to report on the work done under this item on the basis of a fiscal year. The following briefly summarizes the activities which have been conducted with funds made available under the authorization for the control of incipient and emergency outbreaks of plant pests. None of the appropriations made under this authorization have been carried in regular Acts providing funds for the Department. The language providing some of these appropriations has required that special reports be prepared and submitted to Congress. One such report was submitted in January, 1938, and another in January, 1939.

Public Resolution No. 20, 75th Congress, authorized an appropriation of \$2,000,000 for the control of incipient and emergency outbreaks of insect pests and plant diseases, including grasshoppers, Mormon crickets, and chinch bugs. It also authorized that the funds appropriated should remain available until expended and the appropriation of such additional sums as might be necessary to replenish the fund to its original amount at the beginning of each fiscal year.

Public Resolution No. 91 (75th Congress) amended this legislation by removing the limitation of \$2,000,000 and authorizing the appropriation of such amounts as might be necessary. Six appropriations have been made under

these authorizations, as follows: Two of \$1,000,000 each, the first by Public Resolution No. 26, approved April 27, 1937, and the second by Public Resolution No. 55, approved July 17, 1937; one of \$2,000,000 by Public Resolution No. 81, approved March 2, 1938; one of \$700,000 by the Second Deficiency Act, fiscal year, 1938; one of \$3,000,000 by the First Deficiency Act, fiscal year 1939; and one of \$1,750,000 by Public Resolution No. 22, approved June 15, 1939. The first two appropriations expired with June 30, 1938; the next two June 30, 1939; and the last two December 31, 1939, although by a provision of the current Agricultural Appropriation Act, \$400,000 of the funds provided by the First Deficiency Act, 1939, remains available until June 30, 1940.

The great part of the funds provided by these appropriations have been used to enable the Department to cooperate with States in combating a widespread outbreak of grasshoppers. The funds have, however, made it possible to take active measures against a newly established pest, the white-fringed beetle. During the early months of 1937 and again in 1938, army worms appeared in outbreak numbers in certain States. These pests can be controlled in much the same manner as the grasshoppers by the application of poisoned bait. A small amount from the appropriations was used for the purchase and transportation of bait materials distributed to and used by cooperating States to combat army worms. During 1937 an allotment was also made to combat outbreaks of Mormon crickets in North Dakota and South Dakota. This was the first time that the latter pest had occurred in outbreak numbers in these two States. Work on control of Mormon crickets was then under way in other States financed from allotments from emergency funds provided for relief. The period during which effective work could be done on Mormon crickets was short and the funds allotted from the emergency relief appropriation were not available for work in North and South Dakota. A small amount was also allocated for work to control Mormon crickets in States where the control work had not been provided for by allotments from emergency funds. In the season of 1938 allotments were made for Mormon cricket control work in the Intermountain States.

In July, 1937, an incipient outbreak of the white-fringed beetle was outlined in limited parts of Alabama and Florida. This insect is a native of South America and was not previously known to occur in the United States. It attacks a wide variety of crops and has demonstrated that it is a potential pest of major importance over a wide area. It has since been found in other regions in these States, and in Mississippi and Louisiana, and allotments of funds for its control have been made from this appropriation. An appropriation item has been requested in the regular appropriation act for 1941 for the control of this insect.

SUPPLEMENTAL FUNDS
(Complete Bureau Statement)

Projects	Obligated, 1939	Estimated Obligations, 1940
<u>Emergency Relief Appropriation Acts:</u>		
Locating and destroying <i>Thurberia</i> cotton plants	\$80,073:	\$69,647
Barberry eradication	1,203,670:	854,887
Eradication of Dutch elm disease	2,901,507:	1,965,085
White-pine blister rust control	1,779,406:	1,255,709
Control and prevention of spread of gypsy moth	939,391:	740,845
Peach mosaic control	129,975:	125,749
Phony peach disease control	278,144:	189,155
Citrus canker eradication	97,481:	59,651
Wild cotton eradication	- -	60,972
Construction of a plant and parasite receiving station at Hoboken, N. J.	385,100:	(a) 14,900
Clearing building site at Hoboken, N. J. ...	24,772:	- -
General administrative expenses	251,768:	198,138
Total, Emergency Relief Appropria-		
tion Acts	8,071,287:	5,534,738
<u>Payments for Agricultural Adjustment</u> <u>(in lieu of sugar tax funds):</u>		
Fruitfly control in Hawaii	737:	- -
Insect pest survey in Puerto Rico	102:	- -
Total, Payments for Agricultural		
Adjustment	839:	- -
<u>Special Research Fund, Department of</u> <u>Agriculture:</u>		
Digestion by leaf eating insects	7,959:	8,000
Effect of artificial control practices on natural enemies of insect pests	16,450:	16,500
Total, Special Research Fund	24,409:	(b) 24,500
Total, Supplemental Funds	8,096,535:	5,559,238

(a) Carried over from allotment under 1939 Act.

(b) Same amount estimated for 1941.

PASSENGER-CARRYING VEHICLES

An increase of \$2,285 (from \$40,900 in 1940 to \$43,185 in 1941) is requested in the authorization for the purchase of passenger-carrying vehicles. It is estimated that this amount will provide for the purchase of 73 cars, of which 72 will constitute replacements.

Of these turn-ins, 53 are of 1936 or earlier model and the average mileage of all machines to be turned in was in excess of 43,000 miles on August 1, 1939. Considerably more mileage will of course be added before the cars are actually exchanged.

The one additional car on which there would be no turn-in is needed at the Brownsville, Texas, station of the Division of Foreign Plant Quarantine because of the recent designation of a member of the Brownsville staff as supervisor of all port inspection activities on the Mexican border. Many of the stations along the Mexican border are at points very difficult to reach by common carrier and it is necessary for this employee to perform practically all of his travel by automobile. It is impossible to provide a car from the present equipment at Brownsville without serious inconvenience of the regular work at that point, and therefore the additional machine is needed.

BUREAU OF BIOLOGICAL SURVEY

Note.-- The Reorganization Act of 1939 and Reorganization Plan No. II transferred the Bureau of Biological Survey to Department of the Interior, effective July 1, 1939.

BUREAU OF PUBLIC ROADS

Note.-- The Reorganization Act of 1939 and Reorganization Plan No. I transferred the Bureau of Public Roads (with title changed to "Public Roads Administration"), effective July 1, 1939.





